Massachusetts Department of Transportation Freight Plan

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massDOT
Massachusetts Department of Transportation

Massachusetts Freight Plan

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All report documents can be accessed on the MassDOT web site at:

http://www.mass.gov/massdot/freightandrailplan

Table of Contents

1 Executive Summary

A freight system in Massachusetts that provides efficient, cost-effective freight movement is an important element of economic competitiveness, especially as domestic and global trade continues to expand. In addition, Massachusetts, with its relatively high per capita income, is increasingly reliant on the delivery of consumer goods via the freight system and distribution centers. The Massachusetts Department of Transportation (MassDOT) recognizes the importance of goods movement to mobility, economic development, and quality of life in the Commonwealth and has therefore developed this comprehensive multi-modal freight plan for the state.

The purpose of the *Massachusetts Freight Plan* (the Plan) is to produce a comprehensive evaluation of the Commonwealth's freight transportation system, its operations, and its effect on economic development and quality of life. In particular, the Plan evaluates the public and private sector benefits of freight system improvements to identify priorities for investment and regulation changes. The Plan is multi-modal and intermodal in its scope, analysis, and recommendations and it is developed from a Commonwealth perspective. It also considers the broader regional and national trends, as well as carefully examining how freight transportation improvements require partnership with local, regional and private sector stakeholders throughout Massachusetts.

This executive summary represents a compilation of data, trends, findings, analysis, and policy recommendations from the comprehensive evaluation of the freight system in Massachusetts. Support for the executive summary is provided in a series of technical reports. The technical reports can be accessed on the MassDOT web site at:

http://www.mass.gov/massdot/freightandrailplan

1.1 STUDY APPROACH

The Plan was developed by MassDOT's Office of Transportation Planning and its consultant team over a two year period and included a series of interviews, focus group sessions, and public meetings in addition to a thorough data collection, research, and analysis process.

The Plan began with evaluation of existing conditions and future trends, followed by identification of key issues and opportunities, and then analysis and prioritization of investment and policy strategies. To complete the wide range of analysis required to develop a multi-modal freight plan, a number of different data sources and analytical tools were gathered, examined, and integrated as documented in the full technical report.

Stakeholder and Public Involvement

A stakeholder and public involvement process was a primary element of the Plan that was initiated early in the process. The stakeholder and public involvement process was undertaken with two primary goals: (1) to inform the public and key regional freight stakeholders about the purpose and content of the freight plan; and (2) to receive input from the public and key regional freight stakeholders about issues and needs. The input provided by the full-range of freight stakeholders has been essential in identifying issues, and assessing potential investment and policy strategies. In particular, the project team engaged a Working Group of freight experts that represented all freight modes from the public, non-profit, and private sectors.

The remainder of the executive summary (and the supporting technical reports) is organized as follows:

Existing Conditions – The first section of the executive summary provides a description of the Massachusetts freight system, the infrastructure conditions and constraints, and the regional, national, international context for trade and goods movement. It sets the baseline of current freight system conditions in Massachusetts for evaluation of freight trends, potential investment strategies, and policy recommendations. Specific elements of the existing conditions are:

- Regional, national and international context – This section describes global trade and logistics trends as well as key regional freight flows and connections as goods movement tends to involve long-distance, multi-state shipments.
- Massachusetts freight system infrastructure and operations by mode – Detailed infrastructure and operational assessments for each mode, highway, rail, seaports, and air, are provided in this section.

Future Conditions – This section is focused on economic and trade trends, issues, and opportunities. The trade and economic analysis examines recent trends in terms of freight's role in the Commonwealth's economy, land use development trends and issues, and key freight flow data by mode, commodity and shipping pattern. Specific elements of the future conditions are: economic, industry and land use development trends, which include measures on economic and demographic growth, freight transportation contributions to the Massachusetts economy, and industrial land use and freight facility data.

- Freight flows, modal choices, and shipping patterns – This section offers freight and trade shipping patterns by mode, commodity, origin-destination shipping patterns, comparing Massachusetts and US trends. It also includes forecasts of freight growth.
- Recent, on-going and planned freight initiatives in Massachusetts – The Commonwealth has a number of recent, current, and planned transportation initiatives that will benefit goods movement and this section highlights some of the key projects.
- Issues and opportunities – This section describes the key freight issues and opportunities for each mode and sets the stage for the investment scenario analysis that follows.

Investment Scenario Analysis – To address the freight issues and opportunities identified above, MassDOT developed a number of potential multi-modal freight investment strategies. Each investment strategy consists of multiple projects and supporting policies. This section presents those investment scenarios in detail, including a discussion of the evaluation criteria and benefit-cost analysis framework and results developed to assess potential freight investments. Specific elements of the investment scenario analysis are:

- Development of investment scenarios and goals – This section presents the process to identify potential freight improvements based on data analysis and stakeholder input, and explains the ultimate goals of freight investments in the Commonwealth.
- Evaluation criteria and benefit-cost analysis framework –The Freight Plan developed a freight-specific set of evaluation criteria as well as customized benefit-cost analysis tools to assess the public and private benefits of freight investments.
- Investment scenario results – Specific outcome metrics for each scenario are provided and include benefit-cost ratios, net present value (NPV), and identification of the freight projects likely to produce the greatest return on investment within each scenario.

Findings and Recommendations – The final section of the executive summary covers key freight analysis findings and a series of policy and investment recommendations to guide the Commonwealth's freight-related initiatives in the near- and long-term. Specific elements of the findings and recommendations are:

- Freight investments with the highest return on investment (ROI) – Based on the investment scenario analysis, this section focuses on the freight investments expected to produce the strongest ROI for Massachusetts, highlighting opportunities for potential Commonwealth participation in funding freight projects.
- Policy issues and recommendations – The concluding section of the Freight Plan includes specific policy issues and recommendations in terms of land use development, freight funding, and the planning and regulatory environment.

1.2 FREIGHT PLAN GOALS

While Massachusetts has developed a number of regional and Commonwealth level transportation studies, this is the first effort to provide a comprehensive multi-modal freight evaluation. Consequently, an important element of this Plan was to develop a unifying vision, and a set of goals and objectives that can be linked to performance measures and evaluation criteria. These metrics will be used to help: a) assess the overall performance and improvement of the freight system; and b) help the Commonwealth to consistently assess and prioritize investment and policy strategies. The goals for the Massachusetts freight system were developed in the context of other MassDOT initiatives and its overall strategic plan.

The MassDOT strategic plan includes a mission statement, "To deliver excellent customer service to the people who travel in the Commonwealth and to provide our nation's safest and most reliable transportation system in a way that strengthens our economy and quality of life." To accomplish this, MassDOT has established goals as follows.[1]

- **Safety –** Manage the nation's safest transportation system
- **State of Good Repair –** Build a quality transportation system and maintain it in a state of good repair
- **Stewardship –** Operate the transportation system in a manner that embraces our stewardship of the Commonwealth's natural, cultural, and historic resources
- **Customer Service –** Deliver superb service that both anticipates and responds to customer needs
- **Efficiency –** Invest public funds and other resources wisely while fostering economic development wherever and whenever possible

MassDOT has also recently issued the GreenDOT Policy Directive, a comprehensive sustainability initiative with a vision that MassDOT will be a national leader in promoting sustainability through the full range of its activities, including strategic planning, construction, and system operations. The three GreenDOT goals are to: 1) reduce greenhouse gas (GHG) emissions; 2) promote the healthy transportation modes of walking, bicycling, and public transit; and 3) support smart growth development. Freight operations are an important consideration in promoting a sustainable transportation system.

In the context of these MassDOT policies, overarching goals were identified for the Massachusetts freight system as presented below.

[1] MassDOT Strategic Plan, May 14, 2010.

- **Infrastructure –** Promote the preservation and improvement of the freight system infrastructure in all modes
- **Operations –** Facilitate appropriate freight system capacity and redundancy, enhance operational efficiency, and achieve a balanced mix of capacity and connections across all modes
- **Economic Development –** Facilitate freight transportation system improvements, policies and investment strategies that will enhance economic development opportunities and manage consumer costs
- **Environment and Quality of Life –** Ensure that the freight system preserves the environment and contributes to the quality of life in Massachusetts

To fulfill these goals, the Plan is focused on providing transportation infrastructure and services in Massachusetts that: 1) facilitate the movement of goods to consumers efficiently and cost-effectively; and 2) support economic prosperity for Massachusetts businesses and a strong quality of life for Massachusetts residents. These goals are consistent with the MassDOT strategic plan. The recommended investments and policies of the Plan were developed in this context and the analysis of benefits and costs of freight improvements explicitly measured: a) the transportation costs, travel time, safety and efficiency of goods movement; b) the environmental benefits of shipping more freight by rail and water; and c) the economic impacts of potential investments. See Chapter 1 of the full technical report for more detail on goals, objectives and the study methodology.

1.3 GLOBAL, NATIONAL AND REGIONAL FREIGHT CONTEXT

Freight transportation involves massive supply chains that function on a regional, national and international scale to deliver goods from producers to receivers and ultimately to customers. The average trip distance of for-hire freight trucks traveling in Massachusetts is over 400 miles with even longer average distances for rail, water, and air cargo shipments.[2] This means that firms that ship and receive goods are focused on transportation connections from origin to destination, essentially ignoring jurisdictional boundaries. Given the relatively small size of Massachusetts, improvements to the Commonwealth's freight system will also have impacts on nearby states (e.g., more inbound freight traveling by rail or water will impact truck volumes on highway corridors like I-84 and I-95 in Connecticut). At the same time, improving freight bottlenecks and capacity constraints in Massachusetts will be most effective when linked to similar improvements in nearby states.

1.3.1 THE EXISTING INTERNATIONAL AND NATIONAL FREIGHT SYSTEM

There is a direct correlation between freight volumes and economic growth, since goods movement and trade are a direct result of business and consumer demand. At the U.S. level, this interdependence has increased substantively as international trade has been increasing as a percentage of Gross Domestic Product (GDP), growing from 10 percent to 30 percent of all economic activity over the past 40 years.

Transportation infrastructure, network congestion, fuel prices, global economic growth, and environmental considerations are important factors that are impacting global shipping patterns and supply chains. Shifts towards just-in-time manufacturing and supply chain logistics have placed a premium on the travel time and reliability of freight shipments and thus the importance

[2] Based on analysis of Massachusetts state-level Commodity Flow Survey data from the U.S. Bureau of Transportation Statistics.

of integrated multi-modal transportation infrastructure. Trends in global outsourcing and low-cost foreign manufacturing have also led to increased long-distance trade of a number of consumer products, especially from Asia via waterborne shipments.

Globally, containerized shipping has led to greater efficiencies across all transportation modes, leading to lower international shipping costs, increased global-level manufacturing and distribution, and concentration of shipper traffic to ports with deep berths, access to domestic markets, and double-stack train connections. The emerging “BRIC” (Brazil, Russia, India, and China) economies, and particularly China, have greatly influenced the flow of commodities and manufactured goods. In five of the ten years between 1998 and 2007, US imports from China grew more than 20 percent annually; for another three they grew more than 10 percent per year. Increased trade from China has led to trans-Pacific trade becoming dominant in the US, with the Ports of Los Angeles and Long Beach becoming the main US gateways. From these ports many containers move to the East Coast via the rail “landbridge”, as this is the most efficient route.

Due to increased congestion at the major West Coast ports, and the large markets on the East Coast, use of all-water routes from Asia, such as the Panama and Suez Canals has increased. One of the main drivers of the increase in all-water routes is the need for transit-time reliability due to the prevalence of just-in-time inventory shipments.

A related global trend is the use of larger ships focused on a smaller number of major ports, and the corresponding trend towards major distribution center facilities that serve entire multi-state regions of the country. The implication for Massachusetts-bound goods is that there are a few primary routes by which goods enter the Massachusetts market. These routes are:

- Asian shipments to the West Coast, most frequently via the ports of Los Angeles/Long Beach, that are shipped by rail to/through Chicago and then by a combination of truck and rail into Massachusetts;
- Shipments to the Ports of New York and New Jersey from Asia, Europe and other markets that most frequently travel by truck to Massachusetts, and less frequently by barge or rail;
- Shipments to Southeastern ports (e.g., Savannah, Charleston, Hampton Roads) from Asia and South America that travel by truck or rail to major distribution centers in the northeast and mid-Atlantic for delivery by truck to Massachusetts; and
- A mix of consumer products and bulk commodities (petroleum, coal) shipped directly to the Port of Boston and other New England and Canadian ports for regional delivery to warehouses and final consumers in Massachusetts.

Within the United States, the surface transportation network of highways and rail is increasingly burdened with high traffic volumes where growth in miles traveled is far out-pacing increases in the capacity of the system. Substantial growth in trade volumes is expected over the next twenty years according to U.S. DOT projections. This means that the level of investment in the freight transportation infrastructure will have a significant impact on the freight industry, efficient goods movement and the ultimate costs to businesses and consumers.

The two maps that follow indicate shipping volumes at the largest international marine gateways in the U.S. and Canada, predominately container traffic as measured as twenty-foot equivalent units (TEUs).

The maps highlight the trucking and rail shipping patterns and volumes by major routes. As shown, high truck volume areas are concentrated in the I-95 corridor from Virginia to Massachusetts, as well as on connections to the Midwest. Projections for traffic volumes exceed capacity on most major Interstate highways in Massachusetts and the eastern US a whole. These congestion points correlate to most of the major US ports, emphasizing the concerns about landside connections and intermodal connectivity to serve economic markets. The rail system is characterized by relatively few major rail corridors. All of the heaviest traveled freight rail corridors from the West Coast connect through the Chicago area.

See Chapter 2.2 of the technical reports for a more in-depth discussion of global, national and regional freight trends.

Forecasts of increased trade flows project that congestion will only increase, especially on the highway system up and down the east coast and on the inland rail system centered on Chicago.

US Highway Average Long-Haul Freight Truck Traffic and Major International Gateways

Tonnage of Rail Intermodal Shipments and Major International Gateways

Source: Federal Highway Administration, Freight Analysis Framework, and American Association of Port Authorities

1.3.2 THE EXISTING REGIONAL FREIGHT SYSTEM

The map below presents the largest regional inbound and outbound freight flows by tonnage for Massachusetts in 2008. Highlights related to these major flows include:

<u>Freight Flow Directionality</u>

- Eight out of ten of the largest flows are inbound and only two are outbound.

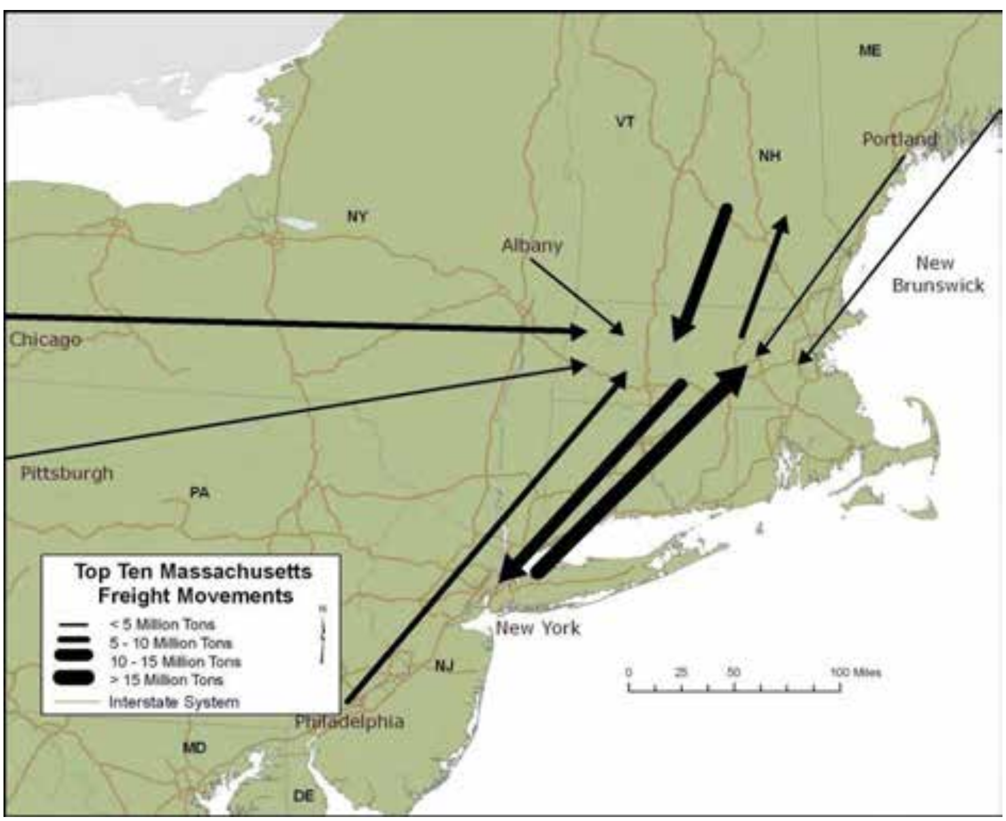
<u>Freight Flow Origins and Destinations</u>

- The largest freight flow is between the New York City metropolitan area (including parts of New Jersey) and Massachusetts with approximately 16.4 million tons shipped to Massachusetts per year. Of this, 77 percent is shipped by truck, 22 percent by water (barge), and only 1.2 percent is by rail.
- The reverse flow (Massachusetts to New York area) is 11.1 million tons with over 95 percent shipped by truck.
- Most other major freight flows are from New England, or the Mid-Atlantic states (the Philadelphia, Albany, and Pittsburgh areas).

<u>Freight Flow Modal Patterns</u>

- The flow with the highest rail mode share is from the Chicago area with over 2.1 million tons of freight rail shipped to Massachusetts and a 44 percent rail mode share.
- The freight flow with the largest water mode share is from New Brunswick, Canada with over 3.7 million tons of marine shipments dominated by petroleum products.

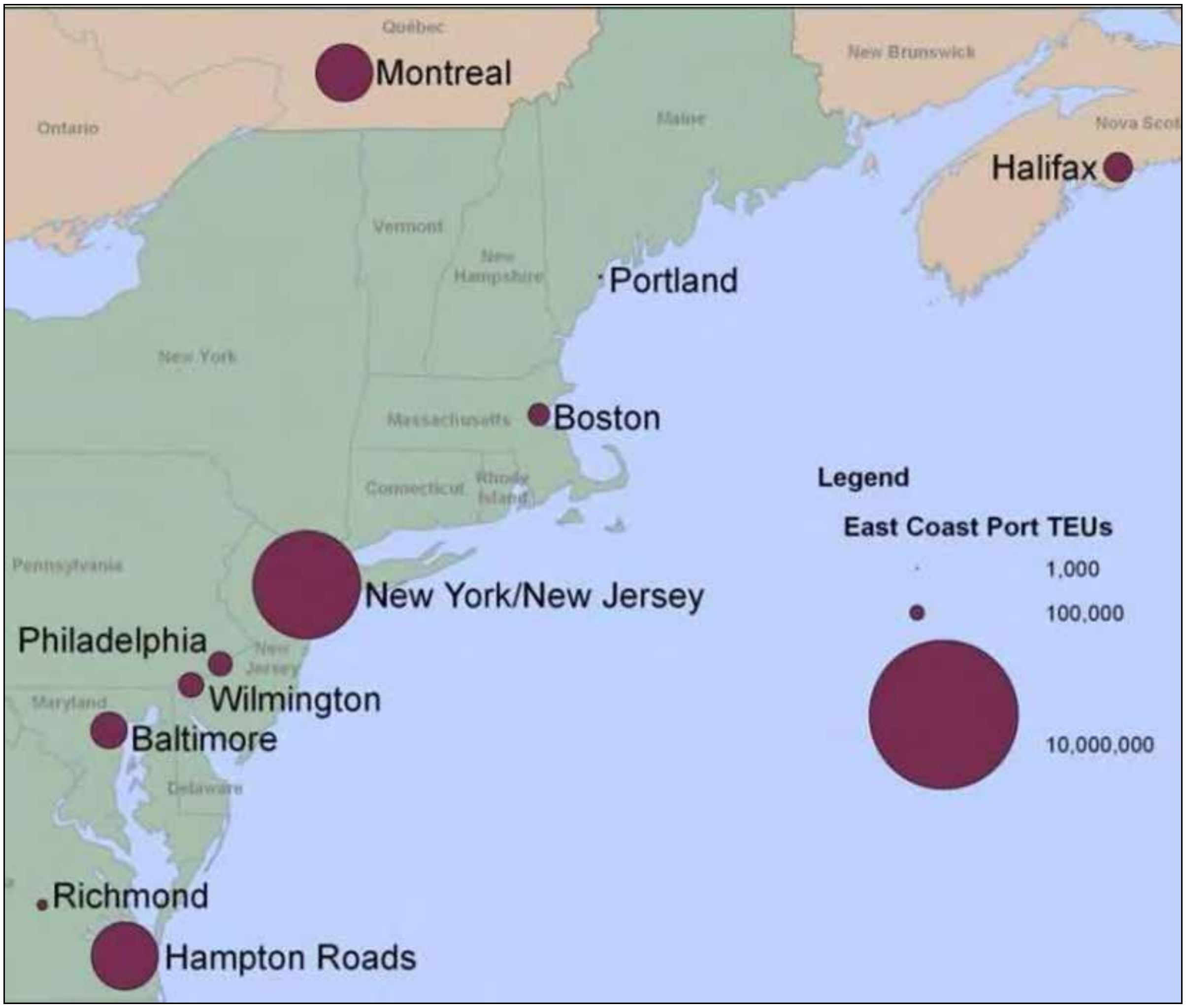
Top Ten Largest Inbound and Outbound Freight Flows for Massachusetts



Source: Global Insight TRANSEARCH 2008 Release

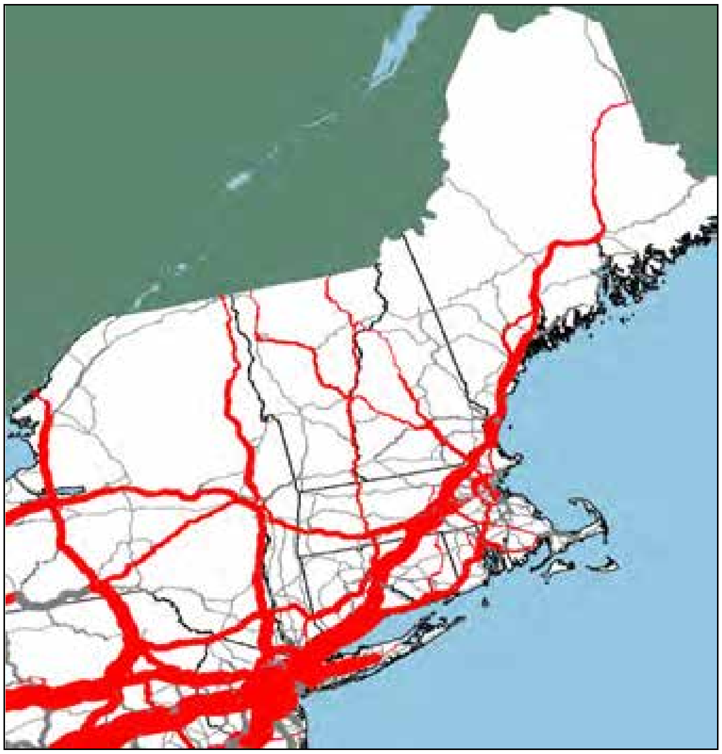
The Port of New York/New Jersey dominates the northeast for maritime containers handled (see map below). Massport estimates that the Port of Boston serves about 30 percent of the region's waterborne freight, helping to explain the large amount of freight flows from New York to Massachusetts with heavy truck volumes on I-84, I-90 and throughout the Boston metro area. Northeast regional long-distance truck flows in 2002 are presented in the map further below, highlighting the very heavy volumes in the New York metropolitan area with the largest flows in Massachusetts traveling along I-90, I-84, I-290, and I-495.

Containers (TEUs) Handled by Northeast Ports in 2008



Source: American Association of Port Authorities

Average Daily Long-Hail Freight Truck Traffic on the National Highway System 2002 in New England and the Northeast



1.4 MASSACHUSETTS FREIGHT SYSTEM INFRASTRUCTURE AND OPERATIONS

This section is focused on depicting the existing Massachusetts freight infrastructure system with analysis of each mode's major facilities, connections, operations and key commodities. It also includes data and descriptions of the Commonwealth's distribution centers and warehouses that interact with the freight system and act as a major generator of freight travel. Each mode is discussed first in terms of infrastructure and then operations.

Massachusetts Freight System – Existing Conditions

The freight system in Massachusetts consists of critical infrastructure and related operations that benefits both businesses and residents by providing multi-modal shipment options, deliveries of consumer products, and jobs for Massachusetts residents. The freight system is also highly complex in terms of supply chain logistics, intermodal connectivity, and linkages to the regional transportation network. In general, Massachusetts is a destination for freight due to its large consumer market, relatively high income per capita, and the dominant role of services and high-tech industries. As a result, the volumes of freight shipped within, through, and out of Massachusetts are significant and are expected to continue growing.

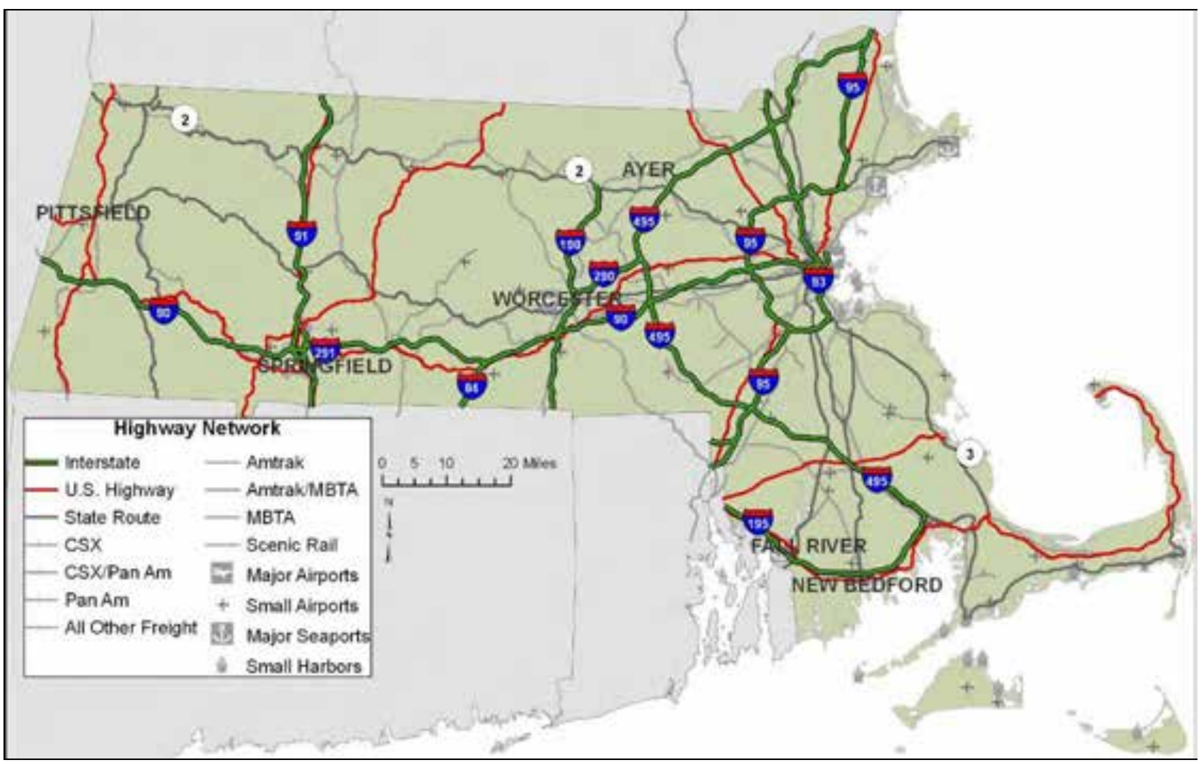
Freight transportation is vital to the Massachusetts economy. The freight and transportation industries in Massachusetts are responsible for moving both goods and passengers throughout New England, maintaining connections and links with the rest of the US, and reaching global markets. An efficient multi-modal freight system is essential for the full-range of Massachusetts industries including receipt of bulk products by rail or sea, and shipment of high-value goods and parcels domestically and internationally. The transportation and logistics sector in Massachusetts employed approximately 122,000 people in 2006 producing $13.7 billion in economic output. In addition, many businesses, such as manufacturing, warehousing, distribution, and agriculture, rely on competitive freight shipments every day to ship and receive goods. This is demonstrated by the observation that an estimated 31 percent of all jobs are "freight-dependent."[3]

1.4.1 TRUCKING AND HIGHWAY SYTEM

Highway Infrastructure

Massachusetts currently has a 7,058-mile system of Interstate highways, state highways, and arterial roadways that connect all major cities and freight facilities. The highway system in eastern Massachusetts is focused on serving the Boston metropolitan area with two major east-west routes (I-90 and Route 2), three major routes from the north (I-95, I-93, and Route 3) and three major routes from the south (I-95, Route 3, and Route 24). I-495 and I-95/Route 128 loop around Boston, providing connections between the major radial highways. I-84 and I-395 provide critical highway access to Hartford and eastern Connecticut. Western Massachusetts is primarily served by I-91 which runs parallel to the Connecticut River and three east-west routes (I-90, Route 2, and Route 9). Other major roadways are Route 1, Route 6, Route 8, Route 20, and Route 202 (see Chapter 2.3 of the technical reports for more detail on highways and trucking).

Massachusetts Highway Infrastructure



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[3] Based on analysis completed by Economic Development Research Group for the Freight Plan.

Freight Trucking and Highway Operations

Trucking is the dominant mode for freight transportation. It is a flexible mode of transportation that can be used at all points of the supply chain from single haul movements to short drayage connections between two modes of transportation. Trucks are often responsible for connecting freight operations between facilities that lack other direct modal connections to airports, rail intermodal facilities, distribution centers, and seaports.

Goods moved by truck account for 239 million tons, or 87 percent, of all freight movements in Massachusetts. The largest share of this tonnage, 38.8 million tons or 16.2 percent, are deliveries of consumer goods from distribution centers and warehouses to their final destination (categorized as secondary traffic). The large secondary traffic volumes reflect the large consumer markets in Massachusetts and most often travel shorter distances in-state after longer-distance shipments by truck, rail, or water. Major bulk commodity movements include nonmetallic minerals, petroleum or coal products, and chemicals or allied products, accounting for 13.7, 12.8, and 10.8 percent respectively. Nonmetallic minerals include non-processed goods such as crushed stone, granite, and phosphate often used in construction and other manufacturing activities. They are large contributors to the Commonwealth's freight truck movements, totaling 37 percent of all truck tonnage in the Commonwealth. Movement of food and/or kindred products account for 12.7 percent of the total tonnage, the fourth largest share.

Top Ten Truck Movements by Commodity in Millions of Tons, 2007

Commodity	Truck Tons	% Share
Secondary Truck Traffic	38.8	16.2%
Nonmetallic Minerals	32.8	13.7%
Petroleum Or Coal Products	30.6	12.8%
Food Or Kindred Products	30.5	12.7%
Chemicals Or Allied Products	25.9	10.8%
Clay, Concrete, Glass Or Stone	25.6	10.7%
Pulp, Paper Or Allied Products	11.4	4.8%
Primary Metal Products	8.7	3.6%
Lumber Or Wood Products	6.4	2.7%
Fabricated Metal Products	5.5	2.3%
TOTAL TONS	**239.3**	**90.4%**

Source: Global Insight TRANSEARCH 2008 Release

The table below illustrates the top Origin-Destination pairs for truck freight in 2007. The largest share of truck freight is from the New York region into Massachusetts. This is followed by freight originating in the regions surrounding the Boston metropolitan area (Providence, Manchester) traveling inbound to Massachusetts. Also, there is a large amount of truck traffic outbound from Massachusetts to the New York region.

Top Ten Truck Origin-Destination Pairs in Millions of Tons, 2007

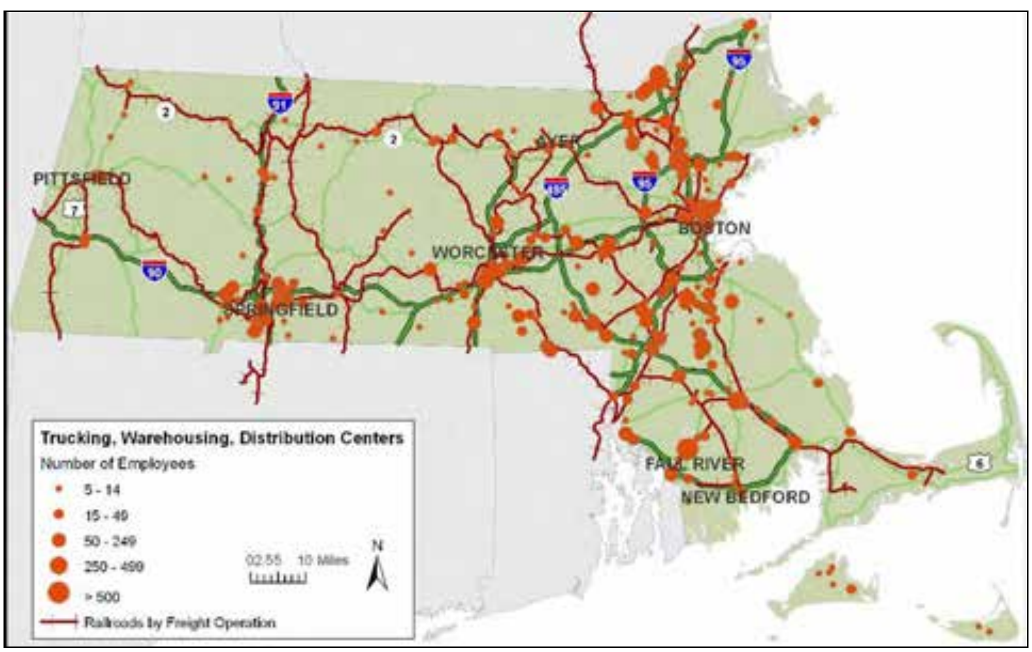
Origin Region	Destination Region	Truck Tons
New York NY	Massachusetts	12.6
Non-MA Boston Region*	Massachusetts	11.5
Massachusetts	New York, NY	10.7
Massachusetts	Non-MA Boston Region*	6.4
Pittsburgh PA	Massachusetts	4.4
Philadelphia PA	Massachusetts	4.3
Albany NY	Massachusetts	3.2
Portland ME	Massachusetts	2.8
Cleveland OH	Massachusetts	2.8
Chicago IL	Massachusetts	2.7

Source: Global Insight TRANSEARCH 2008 Release
* Note: Non-MA Boston Region includes areas in New Hampshire and Rhode Island that are part of the Boston metropolitan region.

Distribution Centers and Warehouses

As part of the freight and highway related transportation infrastructure, Massachusetts has a wide variety of distribution centers, warehouses, truck terminals, and related freight facilities as shown in the map below. These facilities are most often located along major roadways with the largest clusters in the Boston, Worcester, and Springfield areas. Historically, distribution centers were located in the urban core of major cities like Boston to directly serve large local markets and areas in or near Boston continue to have a large number of smaller warehouse facilities. The current trend is to locate larger-scale distribution centers along major highway routes outside of urban centers. This trend is predicted to be the future model for freight transportation for all modes of freight transportation. The prevalence of these facilities near major highways north and south of Boston reflects this trend.

Massachusetts Freight Distribution Centers and Warehousing Facilities



Source: InfoUSA data and HDR calculations

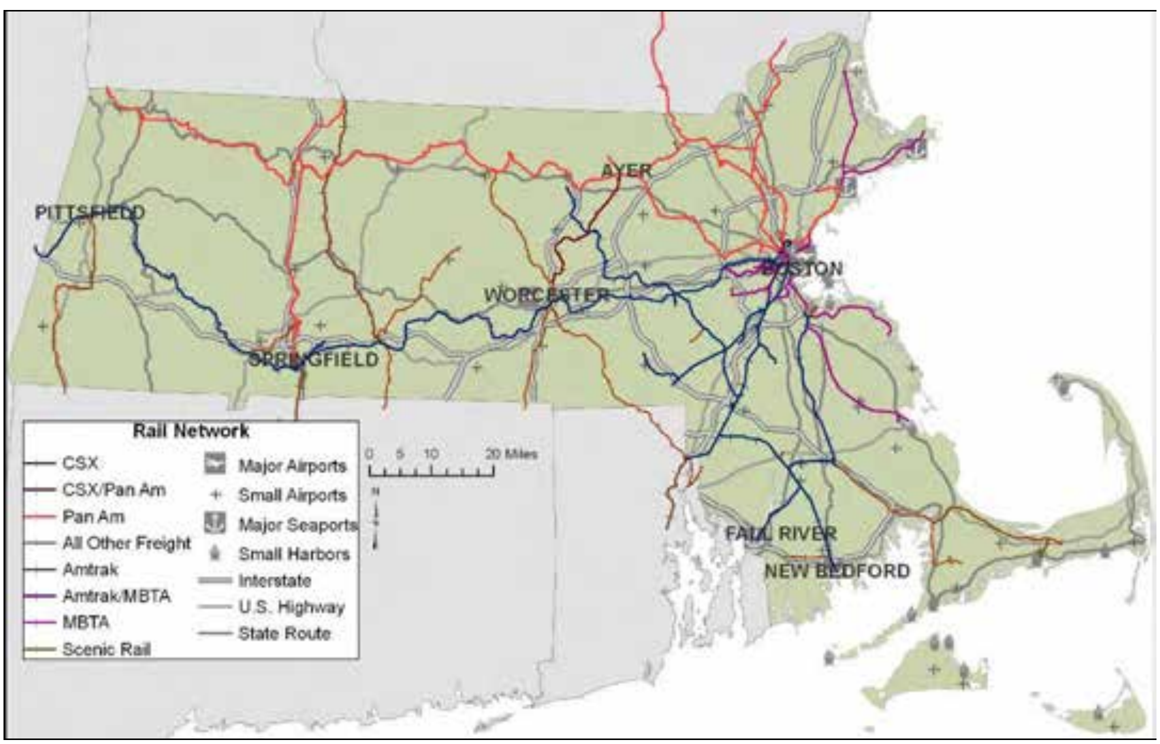
1.4.2 RAILROAD SYSTEM

Rail Infrastructure

Massachusetts has a 1,153-mile railroad system. The rail system contains both freight and passenger operations. Thirteen freight railroads operate in Massachusetts, the largest of which are CSX Transportation, Pan Am Railways, Providence & Worcester Railroad, and New England Central Railroad. These four railroads provide the major rail connections to the national system along three corridors.

- The southern east-west route is provided by the CSX Boston Line which connects to the CSX national system at Selkirk, NY. This is the most heavily used freight rail corridor in the Commonwealth.
- The northern east-west route operates over the Pan Am Railways Freight Main Line connecting to the Norfolk Southern Class 1 rail network at Mechanicville, NY with major rail yard facilities in Ayer and connections to New Hampshire and Maine.
- The most heavily used north-south route utilizes rail owned by both NECR and P&W to connect to the Canadian National rail network through Connecticut and Vermont.
- Short-line railroads such as the Housatonic, Pioneer Valley, Mass Central, and Mass Coastal also provide key freight rail linkages to rail customers from these primary, longer-distance rail corridors.

Massachusetts Rail Infrastructure



Passenger rail operations include multiple Amtrak operated inter-city passenger rail services throughout Massachusetts and the Massachusetts Bay Transit Authority (MBTA) operated commuter rail service throughout the metropolitan Boston area. The major passenger route into

Massachusetts is the "Northeast Corridor" which runs from Boston's South Station through Rhode Island and Connecticut to New York City. Passenger operations also include tourist focused services. Many of the Commonwealth's rail routes are shared use corridors for both freight and passenger travel. See Chapter 2.4 of the technical reports for more detail on freight rail in Massachusetts.

Rail Operations

Rail is traditionally used to ship heavier bulk commodities and other goods that are not very time-sensitive over longer distances. Increasingly, however many rail companies are able to provide better on-time delivery and are expanding into the intermodal container and perishable goods markets. An advantage of shipping freight via rail is the reduced costs that result from rail's added efficiency through increased hauling capacity. Goods moved by rail account for the 6.5 percent of all freight movements in Massachusetts measured in tons. As shown, the largest commodities shipped by rail in Massachusetts are pulp/paper products, mixed shipments, chemicals, and waste/scrap commodities. Given the longer-distance nature of freight rail shipments, a higher share of freight rail traveling in Massachusetts is through-traffic providing trade routes for shippers and receivers in other states. A common rail shipment through Massachusetts is paper products from Maine traveling to the Mid-Atlantic states for printing and publishing

Top Ten Rail Movements by Commodity in Thousands of Tons, 2007

Commodity	Rail Tons	% Share
Pulp, Paper Or Allied Products	2,773	15.5%
Miscellaneous Mixed Shipments	2,148	12.0%
Chemicals Or Allied Products	2,108	11.7%
Waste Or Scrap Materials	2,049	11.4%
Food Or Kindred Products	1,800	10.0%
Clay, Concrete, Glass Or Stone	1,307	7.3%
Coal	1,301	7.3%
Lumber Or Wood Products	1,017	5.7%
Farm Products	958	5.3%
Transportation Equipment	705	3.9%
TOTAL TONS	**17,942**	**90.1%**

Source: Global Insight TRANSEARCH 2008 Release

The table below indicates that the Chicago region was the top freight rail origin-destination for Massachusetts in 2007. This is as expected given the large hub of freight rail operations, including intermodal and transloading operations, in the Chicago area. Shipments from Chicago are often in intermodal containers carrying consumer goods, typically classified as miscellaneous mixed shipments. The remaining top ten origin-destination pairs are all inbound freight shipments to the Commonwealth.

Top Ten Rail Origin-Destination Pairs in Thousands 2007

Origin Region	Destination Region	Rail Tons
Chicago IL	Massachusetts	2,155
Massachusetts	Chicago IL	1,074
Non-Metropolitan Quebec	Massachusetts	851
Non-MA Boston Region	Massachusetts	573
Toledo OH	Massachusetts	307
Cleveland OH	Massachusetts	268
St. Louis MO	Massachusetts	255
Non-Metropolitan Ontario	Massachusetts	252
Indianapolis IN	Massachusetts	240
Albany NY	Massachusetts	239

Source: Global Insight TRANSEARCH 2008 Release

1.4.3 PORT AND MARITIME SYSTEM

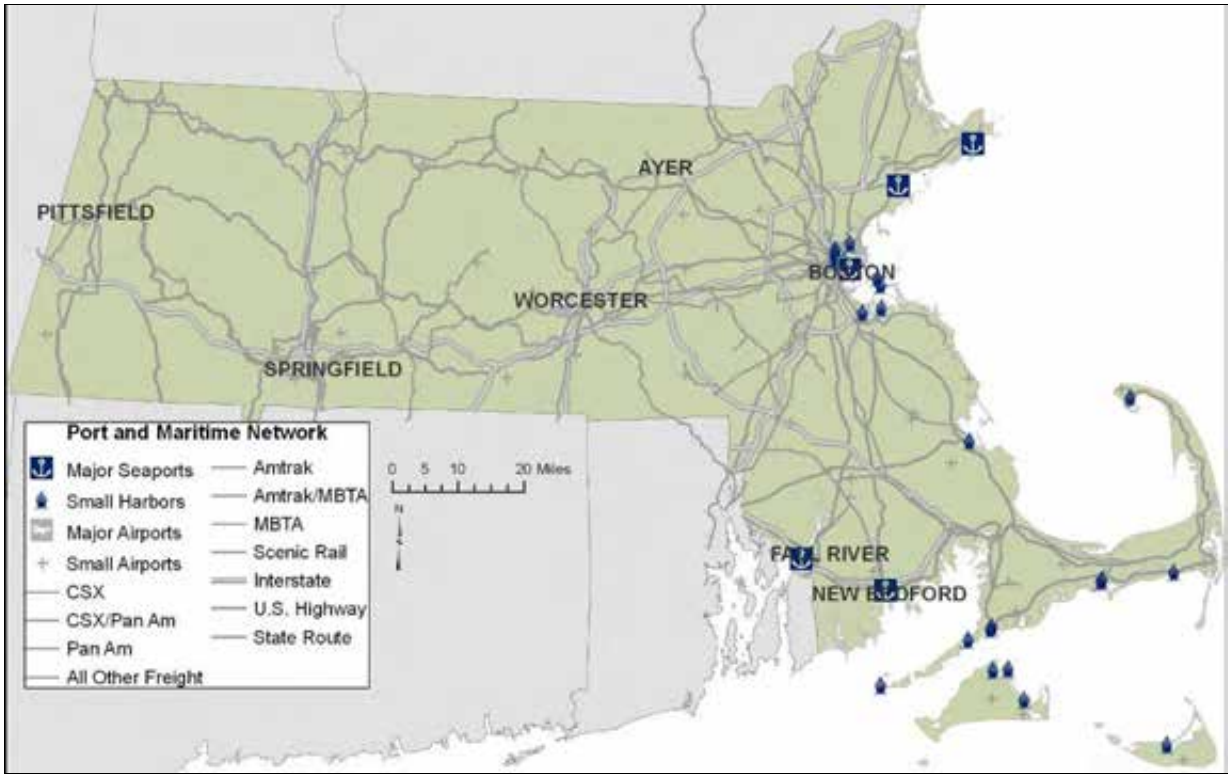
Maritime Infrastructure

There are five seaports in Massachusetts. The largest is the Port of Boston, operated by the Massachusetts Port Authority, which was the 30th largest container port in the US based on the 2007 handling volume of 220,000 TEUs. The Port of Boston also handles a significant volume of petroleum imports through its facilities along Chelsea Creek and the Mystic River along with vehicle imports to the Moran Terminal in Charlestown. Other major ports are Gloucester and Salem north of Boston and New Bedford and Fall River south of Boston. These ports are significantly smaller than the Port of Boston but serve important functions within the Massachusetts economy. The Ports of New Bedford and Gloucester support the Commonwealth's fishing fleet and trade with repair facilities and on-dock processing and storage facilities. The Port of New Bedford regularly qualifies as the top port for value of commercial fishery landings in the United States. The Ports of Fall River and Salem provide maritime access to major power plants, providing energy for the Commonwealth's economy and helping to keep some major bulk shipments off of the surface transportation system.

An important aspect of the Massachusetts port system is that they principally serve local markets. By example, Massport has estimated that 75 to 90 percent of marine freight shipments into the Conley Container Terminal are destined for locations within 100 miles of the port. See Chapter 2.5 of the technical reports for more detail on ports.

Massachusetts also has a large number of small harbors as shown on the map. These usually have limited or inactive cargo shipping, primarily serving passenger ferries and other personal and commercial craft. One exception is that Martha's Vineyard and Nantucket each receive a significant amount of their inbound goods through their harbors.

Massachusetts Port and Maritime Infrastructure



Maritime Operations – The major Massachusetts ports of Boston, Salem, Gloucester, New Bedford, and Fall River ship and receive a variety of commodities both domestically and internationally. Like other modes, the total inbound tonnage is greater than the total outbound tonnage. Goods moved by water account for 4.9 percent of all freight movements in Massachusetts measured in tons. The majority, 66.1 percent or 9.2 million tons, of water movements are petroleum or coal products. This is followed by waste or scrap materials, and nonmetallic minerals, accounting for 12.1 percent and 11.0 percent respectively. Together, these three commodities account for nearly 90 percent of all water traffic in Massachusetts as measured by tonnage. Petroleum products, as a high-weight, large volume good are much more economically shipped by water to the region and then transported by truck to destinations in Massachusetts and the rest of New England.

Container traffic at the Port of Boston, measured in TEUs, was 208,626 in 2008. In context, the Port of New York/New Jersey handled 5.2 million TEUs in 2008.[4] The volume in Boston was a slight decline from the year before due to the economic recession though TEUs have generally been increasing since 2001. The largest single inbound commodity by container is furniture, followed by frozen fish, beer and ale, and still wines. Furniture accounts for approximately 9.4 percent of the TEUs and the top food products combined account for approximately 18.6 percent of TEUs. Outbound commodities are less diverse, with paper and paperboard accounting for more than a third of all containers, automobiles accounting for 11.5 percent and metal scrap accounting for 7.7 percent.

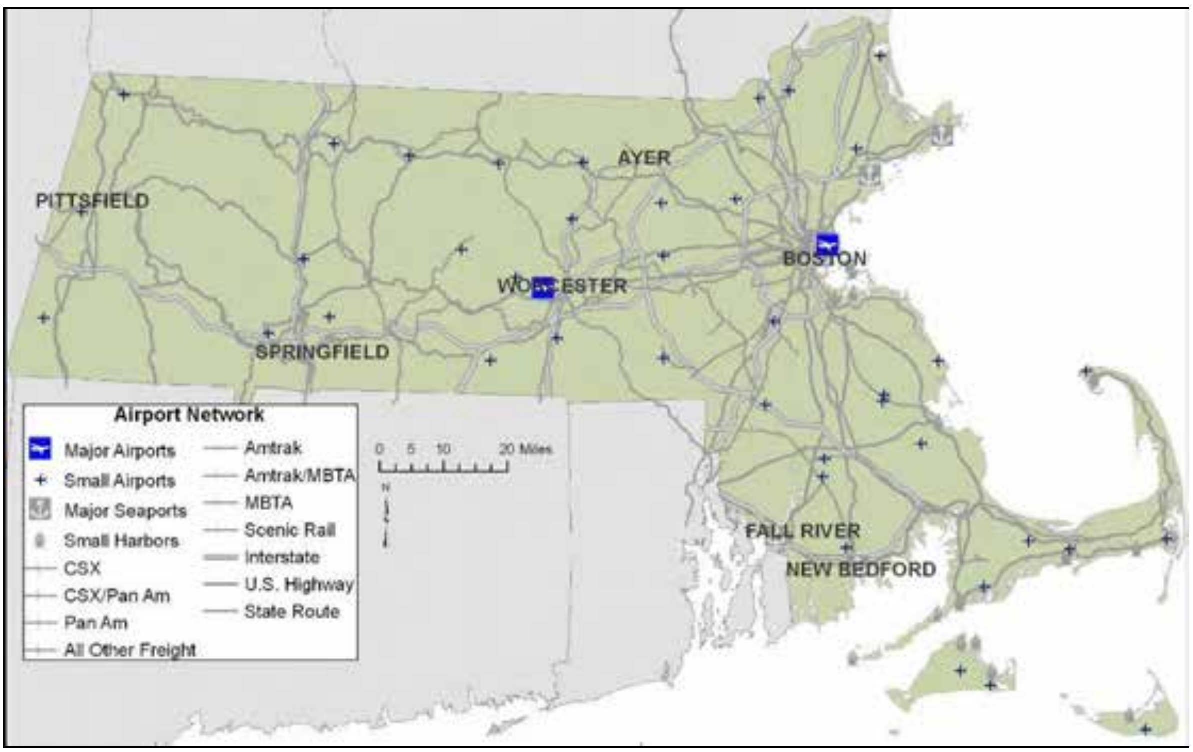
[4] American Association of Port Authorities.

Many of the Massachusetts international trading partners that ship goods on the maritime system are located in Europe and South America. They typically have local or regional distribution center arrangements so that inbound consumer goods travel by truck from the port to a regional distribution center for final delivery to New England markets. Shipping goods by water to Massachusetts generally saves cost in terms of less surface transportation time and miles compared to shipping to competing ports such as New York or Halifax.

1.4.4 AIR FREIGHT SYSTEM

Air Infrastructure – All major air freight activities in Massachusetts are handled at Boston's Logan Airport. Other in-state and out-of-state airports with cargo operations include Worcester; Hartford-Bradley; T.F. Green in Providence; Manchester, NH; and JFK Airport in New York, especially international air shipments. See Chapter 2.6 of the technical reports for greater detail on the Massachusetts air freight system.

Massachusetts Air Freight Infrastructure



Air Operations – Boston's Logan Airport moved 218,965 tons in 2007, and has the most domestic tonnage for all of New England, followed by Bradley Airport's (Hartford) 164,667 tons. Regionally, only Newark and JFK carry more total domestic freight tonnage than Logan Airport. Over $7.1 million of international air freight leaving Massachusetts departed via Logan Airport in 2007 with $5.9 million of inbound international air freight handled at Logan. New York's JFK Airport ships the second largest dollar amount of air freight originating in Massachusetts with over $6.8 billion dollars in 2007.[5]

[5] WISERTrade Data.

Goods moved by air account for less than 1 percent of all freight movements in Massachusetts on a tonnage basis but over 5 percent by value. Air cargo accounts for a small percentage of tonnage because goods that are moved by air tend to be lighter than those hauled by ground methods. Chemicals or allied products account for the majority of tonnage at 24.5 percent, followed by mail or contract traffic at 15.9 percent. Logan Airport's air freight is an almost perfect 50-50 split for inbound and outbound tonnage, which is similar to the patterns at the NY and NJ airports.

International passenger aircraft belly freight is the fastest growing segment of the Logan cargo market and is expected to increase by 15,000-37,000 tons by 2025 according to Massport projections. Air cargo is a critical factor related to international passenger air service as it can play an important role in the profitability of international flights and the number of *direct* international flights is a key determinant of why companies ship through different airports (i.e., the large number of international flights at JFK is a competitive advantage for that airport).

2 FUTURE CONDITIONS – Trends, Issues and Opportunities

This section presents analysis of recent economic, trade, and land use trends, along with forecasts of future conditions. It also includes a discussion of recent and on-going MassDOT initiatives related to freight transportation and concludes with an assessment of key issues and opportunities across all freight modes, setting the stage for the investment scenarios in Section 3.

2.1 ECONOMIC, INDUSTRY AND LAND USE TRENDS

Two of the most commonly cited economic and demographic trends in Massachusetts in recent years are slow population growth and a continuing shift away from employment in manufacturing towards service sector industries. While these trends are very relevant for the Commonwealth's economy and are expected to continue, there has been an increased demand for freight in Massachusetts with freight tonnage increasing by almost 9 percent from 2002 to 2007, with stronger growth by value.[6] The growth in freight demand out-pacing other economic and demographic indicators in Massachusetts is consistent with the national trend of global trade increasing as a percentage of GDP.

It is also important to keep in mind that the Massachusetts economy is not homogenous across the Commonwealth, but rather it is composed of regional economies with similar and differing strengths. An analysis of regional industry concentrations shows that education and health services have a relatively high industry concentration in all regions of the Commonwealth. At the same time, the Pioneer Valley, Central Massachusetts, Southeast, and Northeast regions all show relatively high concentrations in manufacturing sectors relative to the overall U.S. economy. In contrast, the Southeast and the Cape and Islands have a greater concentration in trade and transport.

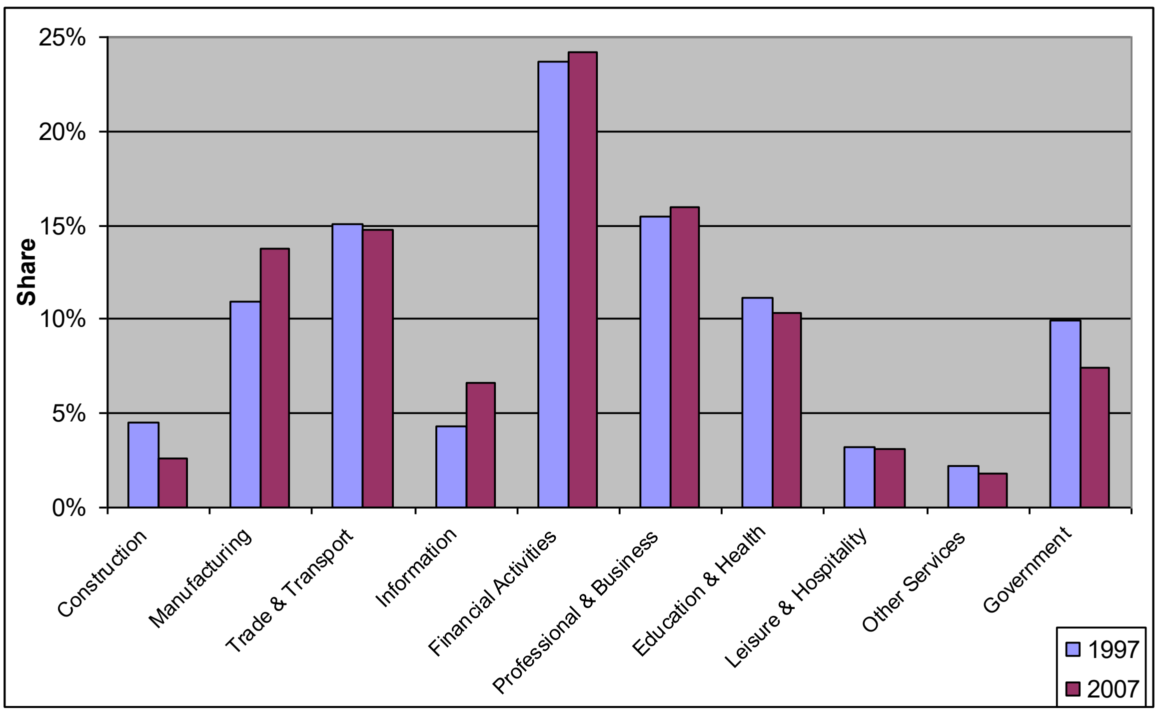
One of the challenges to the Massachusetts freight system and the services provided by freight carriers is that the New England economy as a region is relatively small compared to other parts of the country.[7] The regional growth trends have also been slower than other areas of the country. For example, the New England region has 5.7 percent of total U.S. personal income and is the second smallest market region based on the U.S. Bureau of Economic Analysis

[6] FHWA's Freight Analysis Framework (FAF) historical data series.
[7] Based on the U.S. Census, New England had 4.7 percent of total U.S. population in 2009.

regional definitions.[8] It is dwarfed by the Mid-Atlantic, Southeast and West Coast regions of the country in terms of both the size of the market as well growth over the past 20 years. These market realities often drive private sector investment decisions of where to expand and improve freight infrastructure and services. Chapter 3.1 of the technical reports provides more discussion of economic trends related to freight.

Manufacturing shift to high-value, low-weight products. Despite a drop in the share of jobs within the manufacturing sector, manufacturing output measured in the value of business sales, has increased over the past decade (see figure below). Much of this growth has been in high-value, low-weight products such as medical instruments. In addition, the share of the Massachusetts economy due to international exports has increased from 7.5 percent in 1997 to almost 10 percent by 2007, highlighting the importance of the aviation and maritime modes. Highlighting this trend, from 2000 to 2007 the *tonnage* of total air cargo shipments at Logan Airport decreased by 37 percent, however, from 1997 to 2007 the *value* of air cargo exports increased by 107 percent. Chemicals and allied products are the most typical commodity shipped by air in Massachusetts reflecting the concentration of the life sciences industry in the Commonwealth.

Share of Gross State Product Produced by Industry in Massachusetts for 1997 and 2007



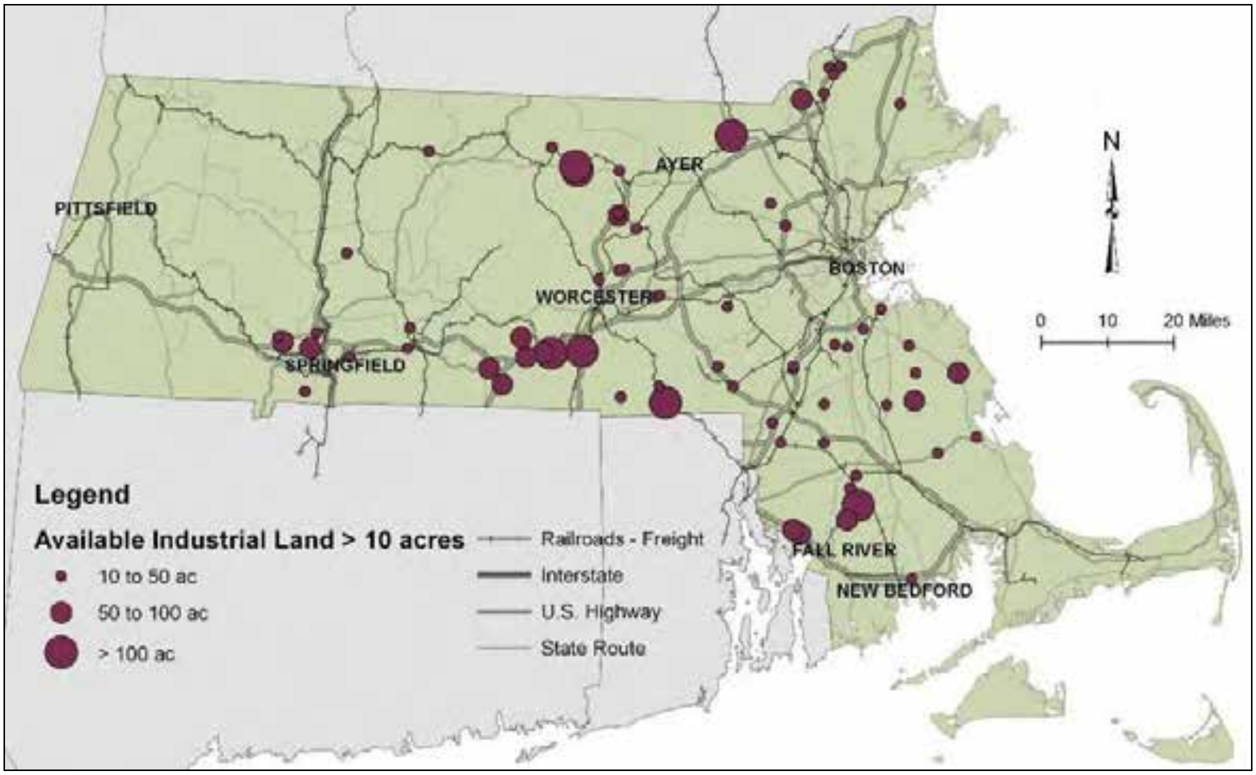
Source: Bureau of Economic Analysis

Large-scale distribution activities are increasingly expanding beyond the Boston metropolitan area. As discussed in a focus group in Worcester on land use development and freight, major distribution and warehousing facilities are often located in the New York, New Jersey, and Pennsylvania region, with regional distribution facilities that serve New England increasingly located outside of Boston but near the I-495 corridor. Similarly, there are few large

[8] Data analysis based on U.S. Bureau of Economic Analysis personal income data series 1990 to 2008, located at http://www.bea.gov/regional/spi/default.cfm?selTable=summary

(100 acres plus) sites available for freight-intensive activity such as intermodal rail-truck terminals in Massachusetts and are often not located east of I-495. And often the new distribution sites that are developed either lack multi-modal transportation access or are configured without taking advantage of existing rail lines. This trend implies that distribution centers are being located further away from the consumer markets, resulting in longer truck travel to final destinations. See Chapter 3.2 of the technical reports for more discussion of land use development issues and opportunities.

Available Industrial Land Sites with 10 Acres or More



Source: MassEcon SiteFinder database

2.2 MASSACHUSETTS FREIGHT TRENDS, FLOWS AND MODAL CHOICES

The economic trends identified above are the significant factors behind freight transportation trends, freight flows, and modal choices in Massachusetts. Some of the key growth trends are noted below.

2.2.1 MODAL CHOICE AND COMMODITY TRADE FLOWS

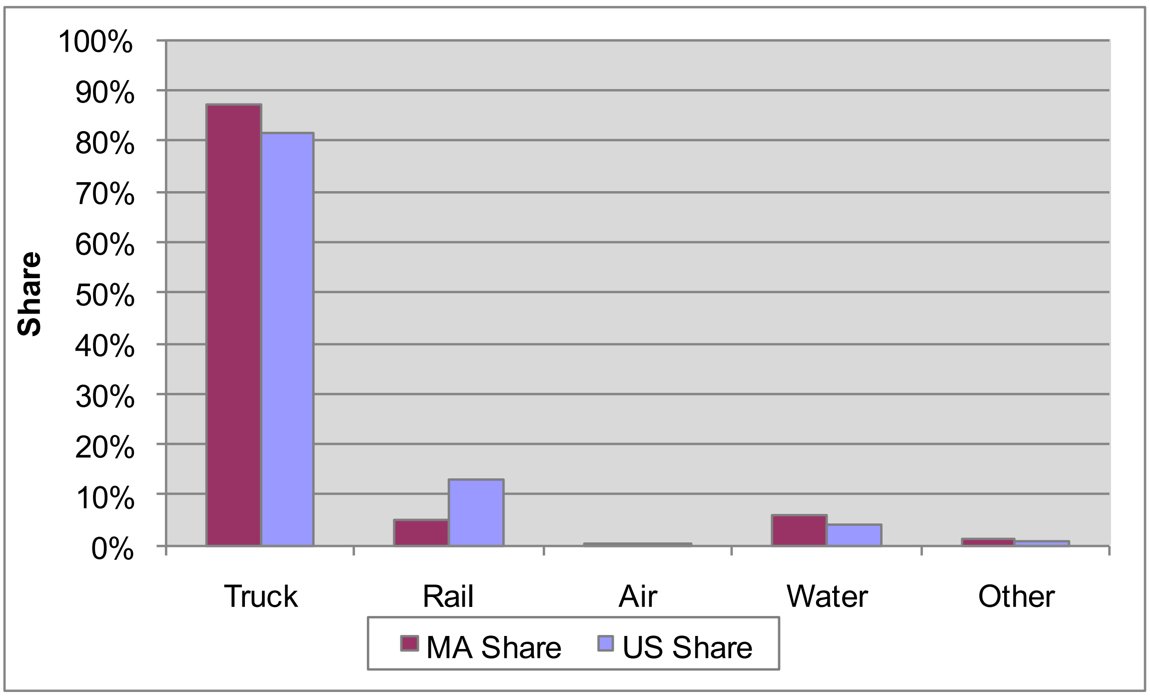
Just over 278 million tons of freight was transported on Massachusetts infrastructure in 2007.[9] Freight moving through the Commonwealth travels by truck, rail, air, water, or a combination of the above.[10] As shown below, Massachusetts is more heavily reliant on trucks and less on rail than the U.S. for goods movement. Massachusetts moves 87.2 percent of its freight tonnage by truck and 7.5 percent of it by maritime shipping which exceeds the respective national shares,

[9] Provided by Global Insight's TRANSEARCH Database.
[10] Commodities traveling via pipeline were not included in this analysis, as the focus is on freight transportation infrastructure.

but moves only 5.0 percent of freight tonnage by rail. Air freight is a very small share of modal movements by tonnage, at 0.1 percent for both Massachusetts and the United States.

Freight transportation demand and infrastructure needs vary greatly by long-distance and short-distance goods movement. Freight shipments vary significantly by weight, volume, value, and time-sensitivity. The largest commodity by tonnage in Massachusetts is petroleum and oil productions, which are almost entirely inbound shipments that enter the Commonwealth at ports and are then distributed by truck throughout New England. The second most common freight shipment in Massachusetts by tonnage is categorized as "Secondary Traffic." Secondary traffic is a distribution category of all commodity flows that represents freight movement from wholesalers, warehouses, and distribution centers, and drayage for rail terminals and airports. Most of the goods in this category are consumer goods that are aggregated at distribution centers before they are shipped to their final retail destination. Secondary traffic, because of the shorter distances and door to door nature of the movements, is dominated by truck shipments.

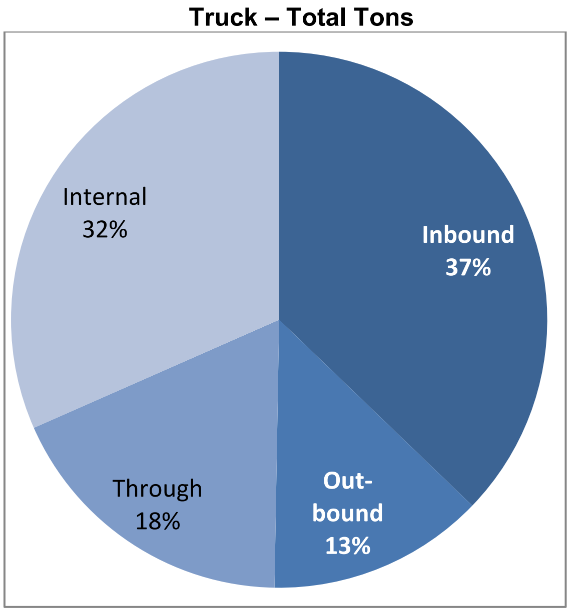
2007 Modal Shares of Tonnage for All Freight Movements Excluding Through Traffic, Massachusetts and US

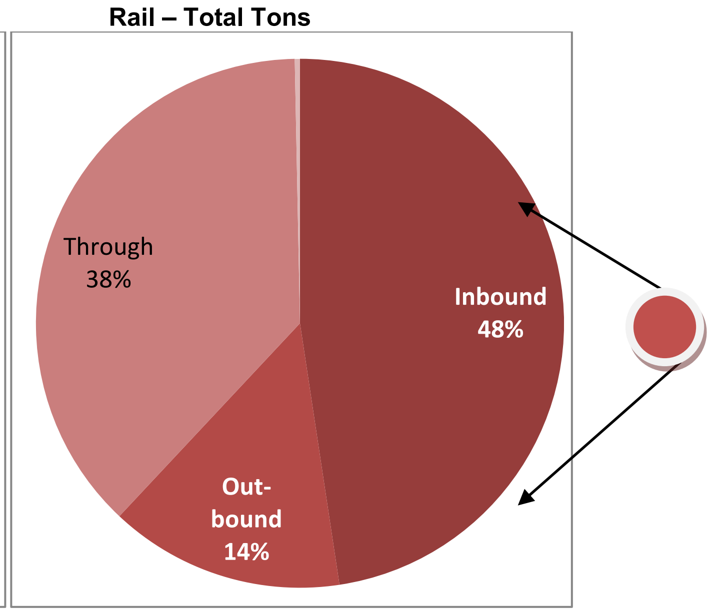


Source: Global Insight TRANSEARCH 2008 Release, FAF 2007 Provisional Release

Inbound traffic dominates freight volumes in Massachusetts, consistent with the strong consumer demand of its residents. Overall truck inbound shipments are more than double outbound volumes with significant through-trip volumes. Most volume carried by truck trips internally within Massachusetts reflects shorter distance secondary traffic movements. For rail, inbound shipments are more than three times higher than outbound from Massachusetts. A significant percentage, almost 13 percent, of the freight volume that travels through Massachusetts is carried by rail, as the rail mode is most competitive for longer-distance shipments. The graphic below shows the share of inbound, outbound, through and internal shipments for truck and rail where the smaller red circle represents the relative volume of rail shipments in Massachusetts compared to truck tonnage

Truck and Rail Shipping Patterns in Massachusetts; 2007





Source: Global Insight TRANSEARCH 2008 Release

Commodity Movements in Massachusetts. The largest movement of commodities in Massachusetts by tonnage, regardless of direction, is petroleum and coal products. With more than 41 million tons, petroleum and coal products accounts for 14.8 percent of all freight (see table below). These energy products are primarily imports to Massachusetts and are a necessary commodity to support the consumption focused economic and residential activity within the Commonwealth. This category is followed by secondary traffic and nonmetallic minerals, which account for 14.0 percent and 12.6 percent of all movements, respectively.

The top commodities by value are fairly different from the largest commodities by tonnage. Electronics and machinery, primarily shipped by truck, account for nearly 28 percent of all value, followed by what is categorized as mixed freight or unknown freight[11] at 11.8 percent, and farm products, food and beverages at 10.7 percent. These are followed closely by textiles and leather (8.6 percent) and chemicals-pharmaceuticals-fertilizers (7.6 percent).

Chapter 3.3 of the technical reports provides a comprehensive commodity flow analysis for Massachusetts.

[11] Mixed freight includes food for grocery and convenience stores, restaurant supplies, office supplies, hardware and plumbing supplies and other miscellaneous shipments. Unknown freight is when the specific commodity is unknown.

Top Ten Massachusetts Commodities for All Modes in Millions of Tons; 2007

Commodity	Total Tons	% Share
Petroleum Or Coal Products	41.1	14.8%
Secondary Traffic	38.8	14.0%
Nonmetallic Minerals	35.2	12.6%
Food Or Kindred Products	32.3	11.6%
Chemicals Or Allied Products	29.3	10.5%
Clay, Concrete, Glass Or Stone	27.1	9.8%
Pulp, Paper Or Allied Products	14.7	5.3%
Primary Metal Products	9.4	3.4%
Lumber Or Wood Products	7.5	2.7%
Fabricated Metal Products	5.6	2.0%
TOTAL TONS	**278.1**	**86.7%**

Source: Global Insight TRANSEARCH, 2008 Release Note: Nonmetallic Minerals includes dimension stone, gravel, sand, refracted minerals, water and broken stone;. Plastics are included in Chemicals or Allied Products

Top Ten Massachusetts Commodities by Value in Millions of Dollars; 2007

Commodity	Value	% Share
Electronics/Machinery	107,498	27.8%
Mixed Freight/Unknown	45,678	11.8%
Farm Prods/food/bevs	41,351	10.7%
Textiles/leather	33,135	8.6%
Chemicals/Pharmaceuticals/Fertilizer	29,298	7.6%
Precision Instruments	20,532	5.3%
Paper	19,439	5.0%
Misc Mfg Products	16,931	4.4%
Transportation Equipment	16,090	4.2%
Base Metals	14,717	3.8%
TOTAL VALUE	**385,992**	**89.3%**

Source: FHWA FAF2 2007 Provisional Release

Additional freight trends include:

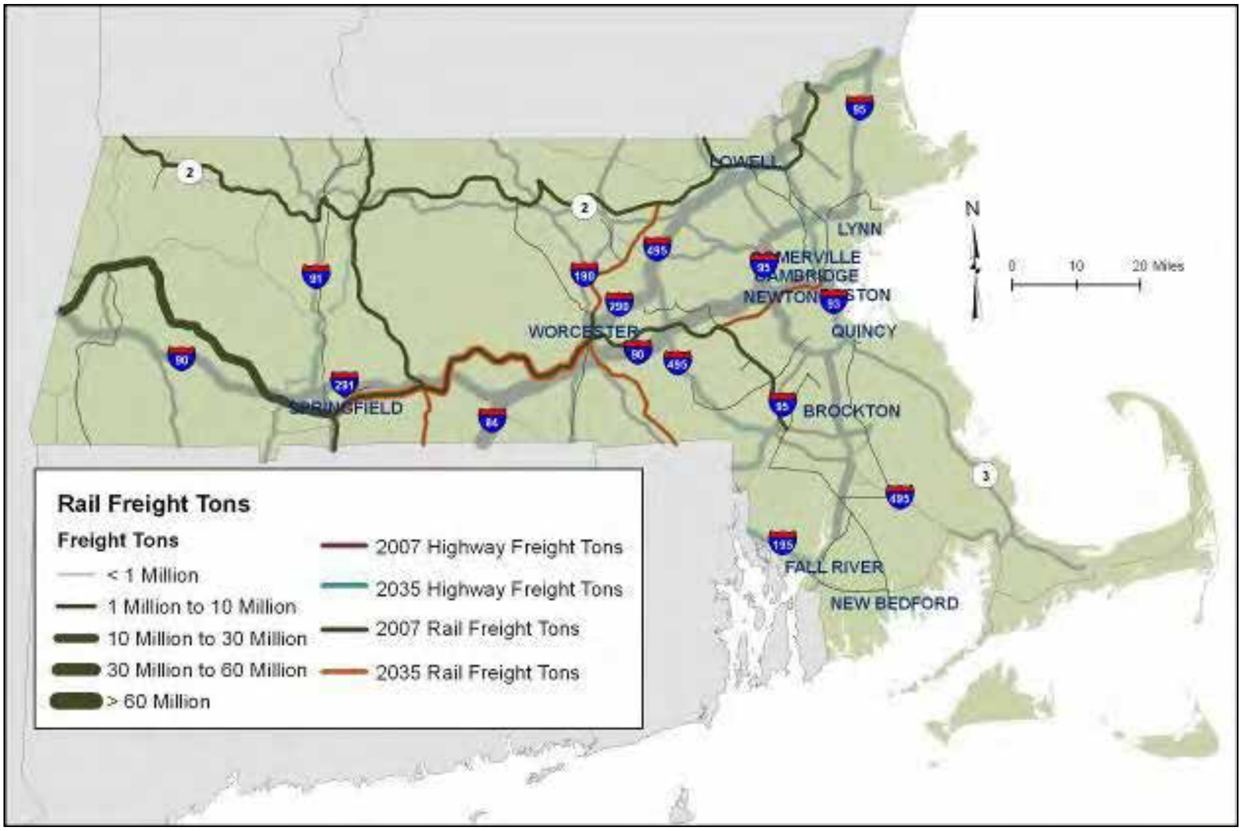
Freight volumes are projected to increase by 70 percent by 2030. Growth in Massachusetts as a consumer market, along with significant through traffic and specialized shipping needs of our high value-added economy are projected to result in goods movement growth, notwithstanding the current economic downturn. As illustration, Massachusetts has the nation's third highest per capita income at over $49,000 in 2007, 27 percent higher than the U.S. average, and comparing populations, the Boston metropolitan area is the 10th largest in the U.S. at over 4.5 million people.

The majority of freight will continue to be shipped by truck. Nationally truck activity accounts for 82 percent of all goods movement on a tonnage basis. In Massachusetts, the truck share of goods movement is even higher at 87 percent. Truck vehicle miles of travel (VMT) have been increasing at a faster rate than auto VMT and have increased their share of goods movement over time. For example, 2009 freight forecasts expect total truck tonnage in and through Massachusetts to nearly double from 239 million tons in 2007 to 412 million tons by 2035. A similar rate of growth is expected for the freight rail and water modes, with estimated rail growth of 18 million to 29 million tons, and for water, from 14 million to 21 million tons. It is important to note that combined rail and water shipments by tons currently, and in the future, are approximately 10 percent of freight handled by trucks.

Expected growth corridors in freight volumes. The figures below identify current and future freight volumes by major highway and rail corridors. The estimated future conditions shown on these maps does not take into account the potential future infrastructure improvements considered later on in this document (e.g., freight rail volumes on east-west corridors do not account for planned and potential enhancements to vertical height and weight-on-rail capacity improvements). Freight moved by trucks is highest on the Massachusetts Interstate system, particularly the corridors moving east from I-84 to I-90 into the Boston metropolitan area. The volumes on I-290 reflect large volumes of through-trips that use that route to connect between I-495 and I-90. In contrast, freight rail volumes tend to be highest in the western half of the Commonwealth and despite fewer shipping routes are significantly smaller than truck volume densities. The lessening freight rail volumes in eastern Massachusetts present a significant challenge in serving consumer markets and businesses as inbound freight rail, especially the intermodal container traffic, transitions from rail to truck to access distribution centers, wholesale trade facilities, and retailers.

Massachusetts Truck Tonnage by Corridor

Massachusetts Rail Tonnage by Corridor



Source: Global Insight TRANSEARCH 2008 Release

2.3 ONGOING AND PLANNED FREIGHT INITIATIVES

To respond to current and anticipated freight needs, both the public and private sector have invested in the freight system and developed plans for potential future projects. Significant freight related initiatives are highlighted below.

Massachusetts Accelerated Bridge Program

In August 2008 Governor Patrick signed legislation creating the Accelerated Bridge Program (ABP). The ABP represents a monumental and historic investment in Massachusetts bridges. Over the next 8 years, nearly $3 billion in funding will be accelerated to improve the condition of bridges in every corner of the Commonwealth, including well-known bridges such as the Whittier Bridge on the key I-95 freight corridor. This program will greatly reduce the number of structurally deficient bridges in the Commonwealth, improve safety, and create thousands of construction jobs on bridge projects.

MassDOT is leading this intensive effort to overcome the past deferred maintenance of bridges and this effort is planned to reduce the number of deficient bridges by 15 percent over the next 8 years. This effort will reverse a trend of the past several decades, and will enhance the highway network's ability to meet the needs of freight mobility in the future.

Major Highway Projects

As displayed in the future baseline conditions map (see Section 4.2), MassDOT is progressing on a number of targeted highway investment projects that will add capacity to the highway system, address key bottlenecks, and improve the flow of freight trucks. These projects include:

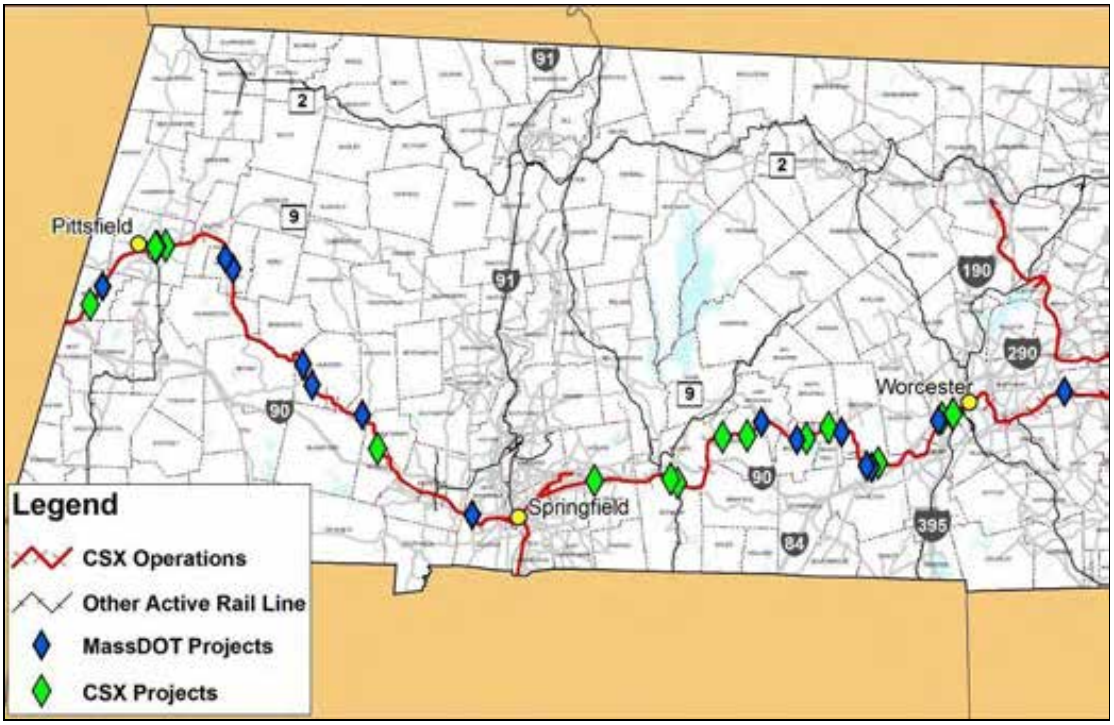
- Widening of Route 128/I-95 from the Mass Turnpike (I-90) to I-93 on the southern side of the beltway.
- Intelligent Transportation System (ITS) improvements on I-91 in the Pioneer Valley.
- Replacing the current traffic signal intersection at Crosby's Corner on Route 2 in Concord with a limited access system for continuous traffic flow.
- Major interchange improvements at I-495 and I-290, I-95 and I-93 north of Boston, and I-495 at Marston Street. Ramp reconstruction projects include I-91 in Northampton and the I-495 South on-ramp from Route 40.

CSX Transaction

MassDOT and CSX recently announced an agreement to relocate and consolidate the Beacon Park intermodal yard, in conjunction with planning to provide second generation (20'8") double-stack vertical clearance between Westborough and the western border with New York (see CSX Double Stack Projects figure below). Second generation double-stack vertical clearance allows for two maximum height intermodal containers stacked together. The CSX transaction agreement is intended to enhance intermodal freight rail services to Worcester and allow expanded and improved passenger rail operation between Worcester and Boston.

The CSX transaction has also converted ownership of freight rail lines that provide connections from Framingham to rail lines currently owned by the Commonwealth in the southeastern part of the Commonwealth (see MassDOT Owned Rail Lines figure in section below) as well as other rail properties in eastern Massachusetts: the Grand Junction Railroad in Cambridge and Track 61 in South Boston. It is anticipated that this will afford opportunities for enhanced freight rail service to the southeast rail lines by enabling short line railroad operations to be established to the CSX mainline connection in Framingham. It will also facilitate implementation of the South Coast Rail commuter rail project.

CSX Double Stack Projects



Pan Am Southern

Pan Am Railways and Norfolk Southern have partnered to establish the Pam Am Southern (PAS) railroad. PAS operates on the rail lines that include the "Patriot Corridor" that begins in Mechanicville, New York, continuing into northwestern Massachusetts and terminating in Ayer. PAS also operates the Conn River line from Springfield to East Northfield at the Vermont border. PAS was formed to provide an improved rail connection in Massachusetts that provides additional options for connections to a Class 1 railroad. Recent track and infrastructure improvements by PAS will provide for 286,000 pound (286k) weight-on-rail capacity between Ayer and the western border with New York. Track speeds will be increased and improvements to the intermodal facilities at Ayer are predicted to increase container traffic handled at that located. The vertical clearance of 19'6" of the Hoosac Tunnel in western Massachusetts will limit intermodal container to single stacked container or double stacked containers with less than maximum height containers.

Federal Stimulus Funded Rail Projects

The 2009 American Recovery and Reinvestment Act (ARRA) led to additional rail funding opportunities in Massachusetts through the High Speed Intercity Passenger Rail (HSIPR) and Transportation Investment Generating Economic Recovery (TIGER) programs. Two rail projects awarded ARRA stimulus funding with freight-related benefits in Massachusetts include:

- **Knowledge Corridor –** The Federal Railroad Administration awarded MassDOT $70 million in the first round of the competitive HSIPR program to rehabilitate 49 miles of track and construct two stations for the Vermonter train service in Western Massachusetts. This project is complemented by others in Connecticut and Vermont that will improve service on the entire New Haven - St Albans corridor. Pan Am Southern will rehabilitate the line for passenger operation with oversight provided by the

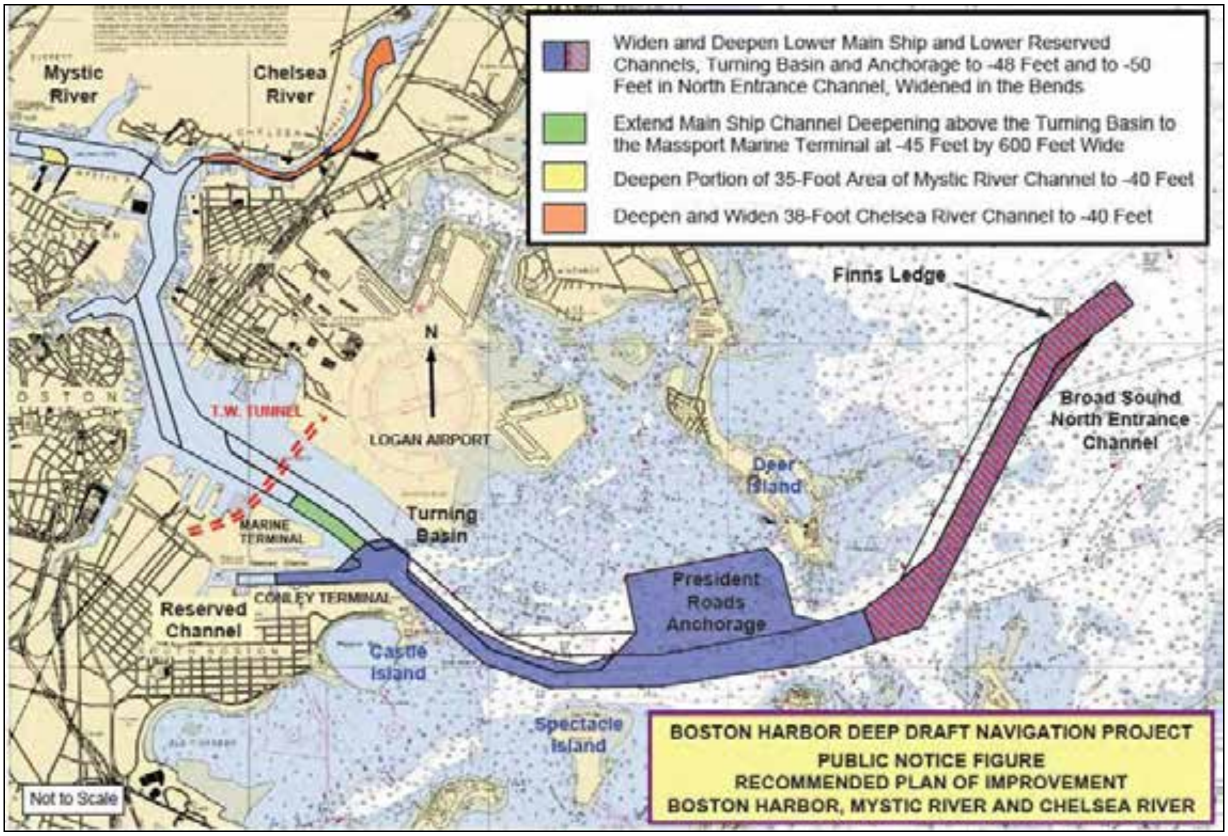
MBTA Design and Construction Department. Service is expected to begin in October 2012. This project will also provide significantly improved freight rail service in the Pioneer Valley with expected growth in freight rail customers in Massachusetts and Connecticut.

- **South Coast Rail Bridges TIGER Project –** Massachusetts was awarded TIGER Discretionary funds to reconstruct three structurally-deficient bridges immediately north of the planned Whale's Tooth Station in New Bedford for the South Coast Rail project. The bridge work will cost $20 million and is the first step in the groundbreaking "Fast Track New Bedford" project that will help revitalize New Bedford's waterfront and initiate construction of a key component of South Coast Rail. The most immediate benefit of this project, however, is to freight rail shipments from the Port of New Bedford and other local freight shippers.

Port of Boston Improvement Dredging Project

To expand the capacity for larger ships, an Army Corps of Engineers (USACOE) feasibility study has recommended that the navigational channel access to Conley Container Terminal be deepened to 48 feet and that the entrance channel be deepened to 50 feet depth. The figure below provides the recommended plan of improvement for the Port of Boston Improvement Dredging Project.

Deeper port navigational depth is important for the Port of Boston's growth strategy and the potential to move more freight by water thus saving highway travel. Since improvement dredging is costly, USACE funding support is important to financial feasibility of the project. The implications of not deepening the channel include continued vessel delays due to the wait for tidal levels to be sufficient and elimination of Boston from vessel service networks that operate larger ships.



Source: Boston Harbor Deep Draft DFR-SEIS-EIR --- Public Notice 4-18-08

MassDOT Freight Rail Program

MassDOT is charged with the care and control of a portfolio of railroad properties on behalf of the Commonwealth of Massachusetts. The portfolio includes approximately 100 miles of active railroad rights-of-way, approximately 35 miles of inactive rights-of-way, and 80 acres of railroad property. The Commonwealth acquired most of the properties in the early 1980s in order to preserve rail service on light density freight lines that otherwise would have been abandoned by their respective railroad owners.

MassDOT Rail Properties

MassDOT has maintained freight rail service on its acquired properties by contracting with various private railroad companies. Currently, MassDOT has license and operating agreements with two railroads for two separate lines. These agreements contain terms under which each railroad operates, maintains, and improves their respective licensed properties. In particular, MassDOT requires in each agreement that the operating railroad maintain their respective lines and MassDOT at its discretion makes capital improvements to each property, including the initial $2.5 million Heavy Repair Program on the lines in Southeastern Massachusetts.

MassDOT Owned Rail Lines

2.4 FREIGHT ISSUES AND CONSTRAINTS

The economic, trade, and commodity flow trends described above are directly linked to operation and conditions of the freight infrastructure system. While the existing freight system provides reasonable freight efficiency and costs, there are a number of infrastructure issues and capacity constraints that currently, and in the future will, limit the flow of goods and inhibit the modal choices for shippers and receivers of goods. Some of the key issues and constraints include:

Freight transportation infrastructure is aging. Massachusetts' older infrastructure is in need of improvement to continue to accommodate existing freight movements and support the larger, heavier, and more cost-efficient loads that are becoming the standard in the freight industry. However, support for funding freight transportation improvements has traditionally been challenging. Examples include the following:

- Of 5,018 bridges in the Commonwealth, 2,572 are either structurally deficient or functionally obsolete. The Accelerated Bridge Program will address this challenge and reduce the number of structurally deficient bridges, but there will still be a large number of bridges in need of rehabilitation or replacement.
- Traffic congestion and delay continues to grow with over 93 million hours of person delay on Massachusetts highways.
- Many of the Commonwealth's freight rail corridors lack either 286k weight-on-rail capacity and/or second generation double-stack capacity – critical capacity factors for competitiveness.

- The Commonwealth's seaports are seeking funding support to deepen the port navigational depths for greater domestic and international shipping opportunities and to improve truck and rail access to their facilities. Greater navigational depth will allow for larger ships at marine terminals which is a competitive factor in today's maritime shipping markets.

On a national scale, recent national studies have highlighted the need to expand the financial resources to maintain and expand the freight transportation system:

- The National Transportation Policy and Revenue Commission specifically recommended the creation of a national Freight Transportation Program to enhance global competitiveness. It estimated that the U.S. is spending only 40 percent of the $225 billion per year needed to maintain a state of good repair on the nation's multi-modal transportation system.
- The American Association of Railroads estimated that $148 billion is needed for freight rail investment over the next 28 years to meet anticipated future demand.

Freight transportation activity often conflicts with other land uses. Real estate developers, often with support from municipalities, typically seek to redevelop potentially valuable industrial land with the "highest and best use," i.e. that which will yield profits for the developer and higher taxes for the municipality. As a result, residential and commercial development has crowded out much of the traditional areas devoted to industrial and freight-intensive uses. This trend is likely to continue as freight activity is often viewed negatively by local communities. Implementing regulatory changes with sustained policy incentives to preserve and strategically locate freight activities has been challenging.

Most freight transportation issues are linked to passenger transportation. In Massachusetts, many rail corridors are subject to complex ownership and operation agreements between private freight railroads and public passenger services by Amtrak or the MBTA. This shared usage of tracks presents the challenge of scheduling to avoid bottlenecks, but also provides an opportunity for public-private partnerships to fund improvements. Additionally, the trucking industry is hindered by the same traffic congestion that affects auto traffic in the Commonwealth. Plus, the success of air cargo at Logan Airport is heavily dependent on scheduled commercial passenger flights for the use of "belly cargo" and the prevalence of direct flights to international destinations.

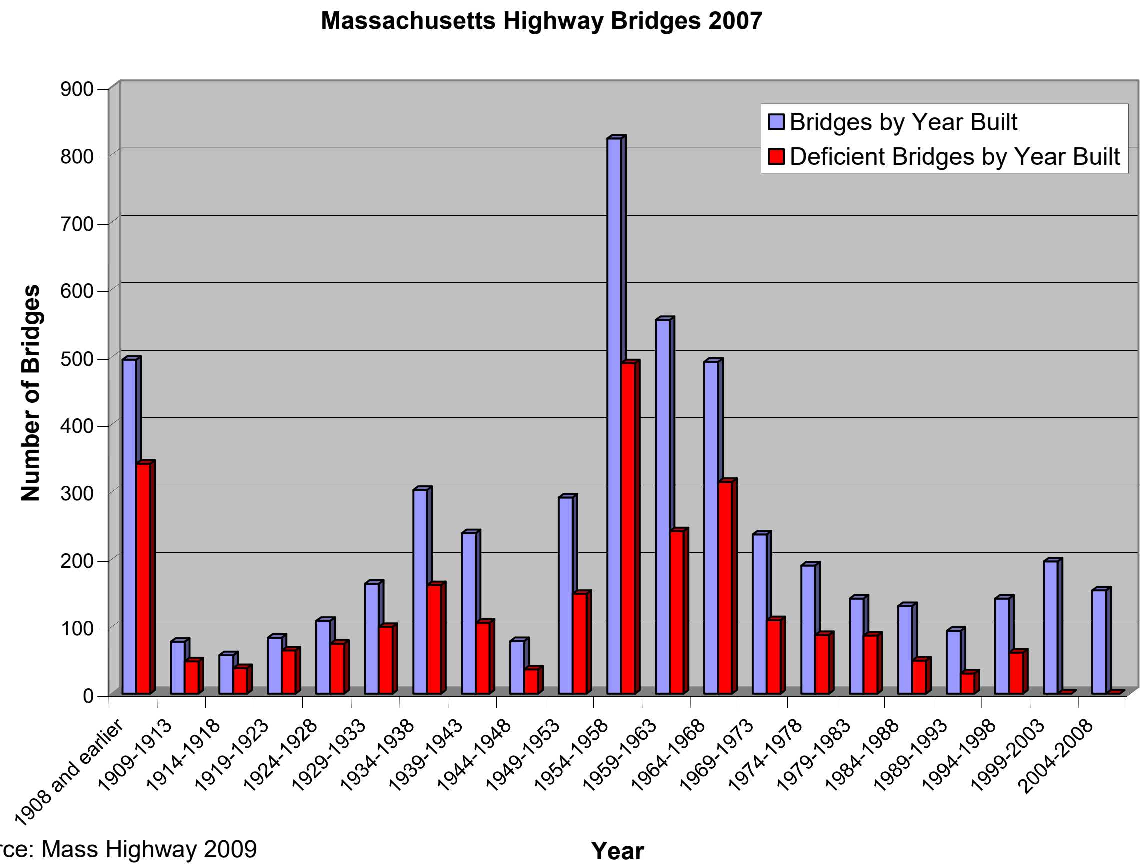
Challenges to realize the most efficient delivery of freight goods is presented below.

Highway and Trucking

- **Highway Congestion and Bottlenecks.** Trucks are rarely more than 15 percent of traffic volume on Massachusetts highways, and are estimated to be less than 9 percent of all traffic on key Boston metropolitan area highways such as I-93, I-95, and I-90 (east of I-495). However, trucks have a disproportionate effect on congestion due to their size and acceleration/deceleration capabilities. There is also a concentration of truck volumes along I-90 and the connecting roadways which identifies that automobile drivers face high levels of truck traffic on these routes. Traffic bottlenecks of concern with heavy truck and auto volumes include most sections of I-93, I-90 from Westfield to Boston, sections of I-495, I-290, and I-95 as well as some other select truck bottlenecks near Lee and Pittsfield, along Route 2 near intersections with I-495 and I-190, and sections of Route 3 and Route 24.

- **Bridge Deficiencies.** Highway bridges in Massachusetts are a critical link in the Commonwealth's highway infrastructure. Based on input from MassDOT, FHWA reported that as of December 2007 there are 5,018 bridges in the Commonwealth of Massachusetts. Of that total, 2,572 are either structurally deficient or they are functionally obsolete. A structurally deficient bridge denotes a bridge deck, superstructure, substructure, and/or culvert that is in poor condition. The $3 billion multi-year Accelerated Bridge Program is actively working to rehabilitate and repair a number of structurally deficient bridges throughout the Commonwealth.

Massachusetts Bridge Deficiencies



Source: Mass Highway 2009

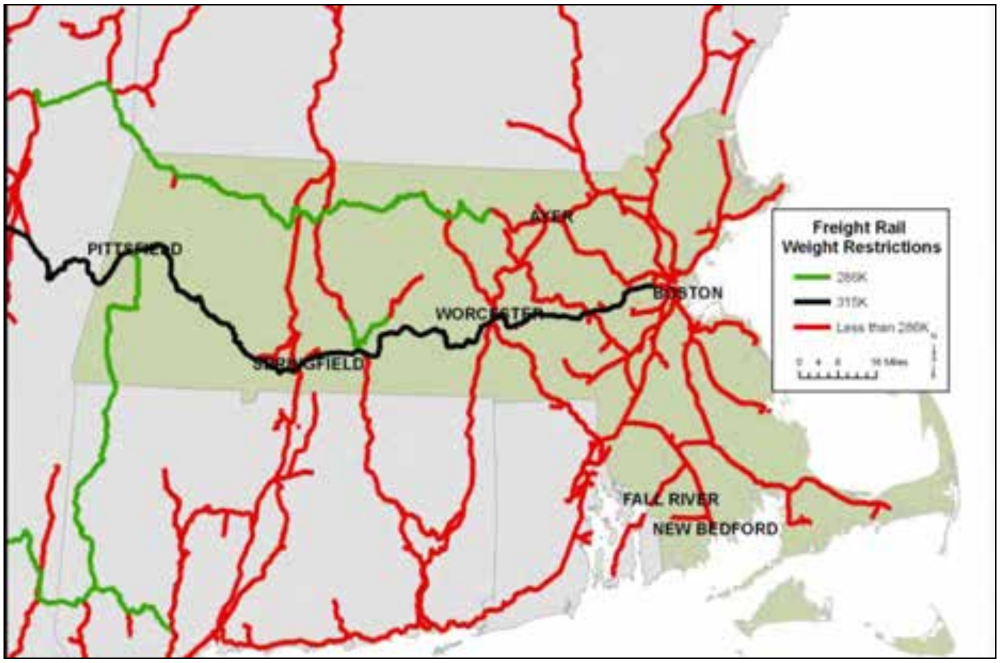
- **Truck Impacts.** High truck volumes impact pavement and bridge conditions, require more energy per ton mile traveled, and result in greater emissions.
- **Intermodal Connections.** Need for improved "last mile" connections to other modes – rail, air and maritime.
- **Truck Route Restrictions.** Bridge weight limits, overweight route restrictions, municipally imposed truck bans, and hazardous material restrictions can result in longer truck routes or use of less appropriate roadways.
- **Lack of Truck Stop Facilities.** Massachusetts has relatively few truck stop rest area facilities (especially in the Central Massachusetts area between I-84 to I-495) and thus the existing ones are over-crowded, resulting in safety and security issues.

Freight Rail

- **Rail Network.** Massachusetts has generally strong rail network coverage that reaches most areas in the state. The Commonwealth's rail network represents about 25 percent of the entire network in New England although it carries more than 40 percent of all freight rail moving through New England.
- **Rail Impacts.** Freight shipped by rail rather than truck can reduce highway traffic congestion, emissions, and pavement impacts.
- **Vertical Clearances.** Vertical clearance is the envelope of space available between top of rail and the lowest point of an overhead structure of a rail line. Significant attention is now paid to "Second Generation" double-stack intermodal container traffic and the need to clear 20'8" on rail corridors. A key element of the CSX transaction with the Commonwealth is to partner to provide full double-stack clearance from the New York border to Westborough to take advantage of the cost efficiencies of that intermodal container service. Thus, increasing vertical clearances to provide a better networked freight rail system linked to regional and national corridors presents an opportunity to improve the competitiveness of rail in the Commonwealth.
- **Weight Restrictions.** Over many years, the freight railroads have been transitioning from the traditional standard of 263k weight-on-rail to a heavier gross weight of 286k for individual rail cars. This transition allows for more efficient and cost-effective transportation of heavy bulk goods. Only three railroads in Massachusetts have any significant amount of trackage that is approved for 286k weight-on-rail as shown in the map below[12]. Certain limited portions of the Providence & Worcester are rated to carry 286k weight-on-rail cars, and the entire Housatonic Railroad (in Massachusetts and Connecticut) is rated at 286k. The entire CSX Boston Line exceeds the 286k weight-on-rail capacity and is rated to carry cars weighing up to 315,000 pounds, though the secondary tracks (branch lines) are generally rated at 263,000 pounds. The PAS freight main line from Mechanicsville, NY to Ayer will be upgraded to 286k weight-on-rail capacity as part of the Patriot Corridor project. All other railroads in the Commonwealth are currently rated at 263k weight-on-rail.
- **Rail Access.** Many businesses along rail lines need to build or upgrade the rail sidings that serve them. This infrastructure expense is generally far higher that most highway connections and thus limits opportunities to ship by rail. Development pressures on rail-adjacent land have also reduced the potential pool of rail-served businesses and many new industrial sites do not have rail access.
- **Shared Use, Rail Congestion, and Competing Demands.** Much of the freight rail system operates on corridors that also have commuter and/or intercity rail passenger rail service. Shared use rail operations creates challenges for scheduling and dispatch, safety, and the need for suitable switching and signal equipment. Shared use operations often require investment to install double-tracking and passing sides for the most heavily traveled routes such as on the Northeast Corridor, Worcester-Boston route and the Downeaster route. The principal conflict with shared corridors comes when the combined use by passenger and freight rail needs exceed capacity. In Massachusetts, current and planned shared use corridors have the ability to provide sufficient capacity for near-term needs on most rail corridors.

[12] The 286,000 pound discussion is based on four axle trucks. With the exception of specific heavy haul cars available at premium rates and utilized to move equipment such as transformers and other dimensional or overweight products, all the North American freight car fleet is equipped with four axle trucks. Loads can be moved by exception if six axle rail cars are utilized).

Freight Rail Weight Restrictions by Rail Corridor



Seaports and Marine Transportation

- **Land Use Pressures.** Rehabilitation of urban centers in Massachusetts has placed a premium on development near maritime ports. Although this may be considered a positive trend in general, land uses that are not compatible with industrial port operations may threaten the long-term viability of some port uses.
- **Petroleum the Top Commodity.** The ports handle a majority of the oil and natural gas imported to Massachusetts. Improving the handling of these commodities is important to keep energy costs low.
- **Short Sea Shipping (SSS).** SSS and coastal shipping may offer opportunities to reduce the reliance on trucking, especially on the congested I-95 corridor. SSS has been explored in Massachusetts and the Port of New Bedford offers the greatest potential for SSS operations.
- **Landside Access.** Rail access to seaports in Massachusetts is mixed with some on-dock rail and near-dock rail access. This places a premium on truck access to seaports to improve the efficiency of truck traffic and reduce conflicts with local neighborhoods and passenger traffic. For example, the port of Boston has identified a number of local roadway improvements, including a dedicated haul road, to enhance the efficiency and safety of truck movements from the port to I-90 and I-93. These potential improvements are evaluated in the investment scenarios.
- **Truck Route Restrictions.** A challenge to containerized goods entering the Commonwealth at the Port of Boston is that containers are often heavier than the allowable weights on state and local routes. To transport the goods to inland distribution centers, containers need to be reconfigured to a lower weight or risk a fine. In addition, all hazardous materials are required to avoid the Central Artery and Ted Williams tunnels for safety, however the classification as some relatively innocuous goods as

hazardous results in circuitous routes to the port adding truck VMT to the highway system.

- **Port Depths.** Port depth is a critical capacity issue relating to the ability to move larger and more cost-effective ships to ports of Massachusetts. The Port of Boston has identified a deep draft navigational project that is necessary to improve the competitive position of its port. Many of the other Massachusetts ports have also identified the need for a combination of maintenance dredging and compatible land use development.

Air Freight

- **Critical for Massachusetts Economy.** Air freight is a small but important niche, carrying high-value and highly time-sensitive cargo. As a center of high-value manufacturing and a leader in such “knowledge economy” sectors as biotechnology, pharmaceuticals, and information technology, air freight is critical to the Massachusetts economy. Air freight is projected to grow more quickly than any other mode of goods movement given the structural economic dynamics in the Commonwealth.
- **Landside Access.** While the construction of the Ted Williams Tunnel dramatically improved the utility and accessibility of Logan Airport for air freight operations, congestion of landside connections is still a threat to restrict air freight.
- **International Air Freight.** More direct international flights through Logan could increase Logan’s share of air freight volume, to the benefit of the airport, and manufacturers and shippers in Massachusetts.
- **Safety and Security.** Safety and security requirements at airports can impose a time and cost penalty on air freight.
- **Nearby Warehousing and Freight Forwarding.** Competitive air cargo operations requires nearby warehousing and freight forwarding facilities, which currently exist on-site and off-site at Logan Airport. Preserving sites and developable space for this activity in South Boston and the Route 1 and 1A corridors is a top priority for the air cargo industry.

3 Freight Investment Scenarios and Evaluation

To address the freight infrastructure and operational issues identified above and improve the economic competitiveness of the Massachusetts economy, the Freight Plan has identified a set of potential multi-modal investment scenarios. These scenarios were developed with significant stakeholder input and review, and are designed to address MassDOT’s strategic goals, goals of the Freight Plan, and the following key challenges facing the Massachusetts freight system:

- **Facilitating anticipated growth in goods movement.** Despite the current economic recession, trade and goods movement are expected to continue to grow over the next 20-30 years with the latest projections leading to a 70 percent growth in freight tonnage between 2007 and 2035.
- **Balancing and diversifying the multi-modal freight system.** Massachusetts moves a high volume of goods by truck and relatively low share by rail. Although geographic and market characteristics limit the potential for major mode shifts, a more diversified multi-modal system would benefit shippers and receivers of goods as well as relieving congestion on crowded highways.
- **Reducing congestion and environmental impacts.** Infrastructure improvements that add capacity can reduce congestion for both freight and passenger travel. In particular, shifting future freight growth off the highway and onto the rail and water networks can

result in lower environmental impacts and lower energy consumption per ton mile shipped.

- **Enhancing economic development opportunities** Though sometimes overlooked in as a critical component of the Massachusetts service-based high-tech economy, freight transportation activity and the industries that depend heavily upon efficient freight movements generate jobs and a more diversified economy. Additionally, preserving freight-intensive industry opportunities near market centers can reduce truck travel for final delivery of goods and relieve congestion.

The five freight investment scenarios assessed are:

1. **Truck Freight Improvements –** Recognizing the continued prevalence of truck and highway-oriented goods movement, this scenario examines major highway capacity expansions throughout the Commonwealth, primarily on the Interstate system, to attempt to accommodate growth in freight truck activity along key corridors.
2. **Northern Tier Rail Improvements –** This scenario provides enhanced freight rail corridor connections from the New York border to Ayer, and from Ayer to Maine with emphasis on 286k weight-on-rail and "second generation" double-stack rail capacity upgrades. Such improvements enhance intermodal operations in Ayer and possibly to Maine, and rail connections to Worcester and Springfield.
3. **South Coast Multi-Modal Freight Improvements –** This multi-modal scenario examines improvements to port, rail, transload, and highway facilities in Southeastern Massachusetts. Specific improvements are targeted at the Fall River and New Bedford ports to handle increased cargo throughput, with coordinated investment in truck and rail access to/from the ports, 286k weight-on-rail from the CSX Boston Line through the region, and new transload operations in the region.
4. **Central and Western MA Rail Improvements –** This scenario focuses on second generation double-stack and weight-on-rail north-south rail linkages on Pioneer Valley, New England Central, Pan Am Southern, and Providence & Worcester railroad corridors, in addition to improved truck access to intermodal and aviation facilities, and a full-service truck stop.
5. **Boston Core Multi-Modal Freight Improvements –** This scenario concentrates on facilitating goods movement distribution in Boston through improvements in, to, and around the Port of Boston. In particular, this scenario includes a major channel deepening project in Boston with supporting truck and rail landside access improvements.

Maps and detailed evaluation findings of each investment scenario are provided in section 3.2 below.

3.1 EVALUATION CRITERIA AND COST-BENEFIT ANALYSIS FRAMEWORK

Evaluation criteria were developed to aid in identifying priorities for freight system infrastructure improvements. The evaluation criteria allow comparison across transportation modes by linking freight goals, objectives, and performance measures. Key criteria include:

- Congestion reduction and improved transportation system operations
- Operational costs
- Last mile connections to intermodal, seaport, and airport facilities
- Economic development and land use benefits (e.g., jobs and supporting smart growth)
- Environmental considerations, including emissions

- Local support and consistency with transportation plans
- Safety and security
- Partnership and linkage to regional initiatives
- Availability of funding from federal, local, and private sources

A more in-depth presentation of evaluation criteria and performance measures is in Chapter 4 of the technical reports.

The scenario analysis results presented below are based on the evaluation criteria with emphasis on a comprehensive cost-benefit analysis supported by economic impact results. The cost-benefit analysis (CBA) was developed using multiple data sources, transportation, and economic models, existing study results of planned infrastructure investment, and leading expert guidance and review of all inputs and assumptions. The CBA captures both benefits and costs related to economic, transportation, and environmental factors, evaluating packages of investment projects to help create an integrated freight system. All scenarios examine costs and benefits from 2010 to 2035.

Across all five scenarios, a consistent set of costs and benefits are estimated. Costs include initial capital investments, along with lifecycle operating and maintenance costs over the useful life of the investment. Costs are calculated irrespective of the funding source. Consequently, the analysis focused on identifying potential freight investment priorities and opportunities for Massachusetts while recognizing that the benefits would accrue to both the private sector (freight shippers, receivers, and carriers) and general public. The priorities identified thus do not represent a commitment to fund these projects by the public sector but rather represent projects with high return on investment with an expectation that private investment on privately-owned infrastructure will be required.

Benefits are focused on direct travel efficiency and cost savings as well as secondary benefits to environmental emissions, safety, and infrastructure conditions.

Economic benefits include:

- Shipper cost savings;
- Congestion relief benefits to freight;
- Freight logistics benefits (improved reliability supply chain re-organization); and
- Near- and long-term job creation.[13]

Transportation benefits include:

- Congestion relief benefits for general traffic;
- Reduced public highway maintenance costs; and
- Safety benefits.

Environmental benefits include:

- Emissions reductions, assuming a price of carbon emissions of $34 per ton of CO2 (in addition to other air contaminants such as nitrogen oxides, and particulate matter).

[13] Although these economic benefits occur in the Commonwealth, they are estimated separately and not included in the CBA.

3.2 INVESTMENT SCENARIO ANALYSIS FINDINGS

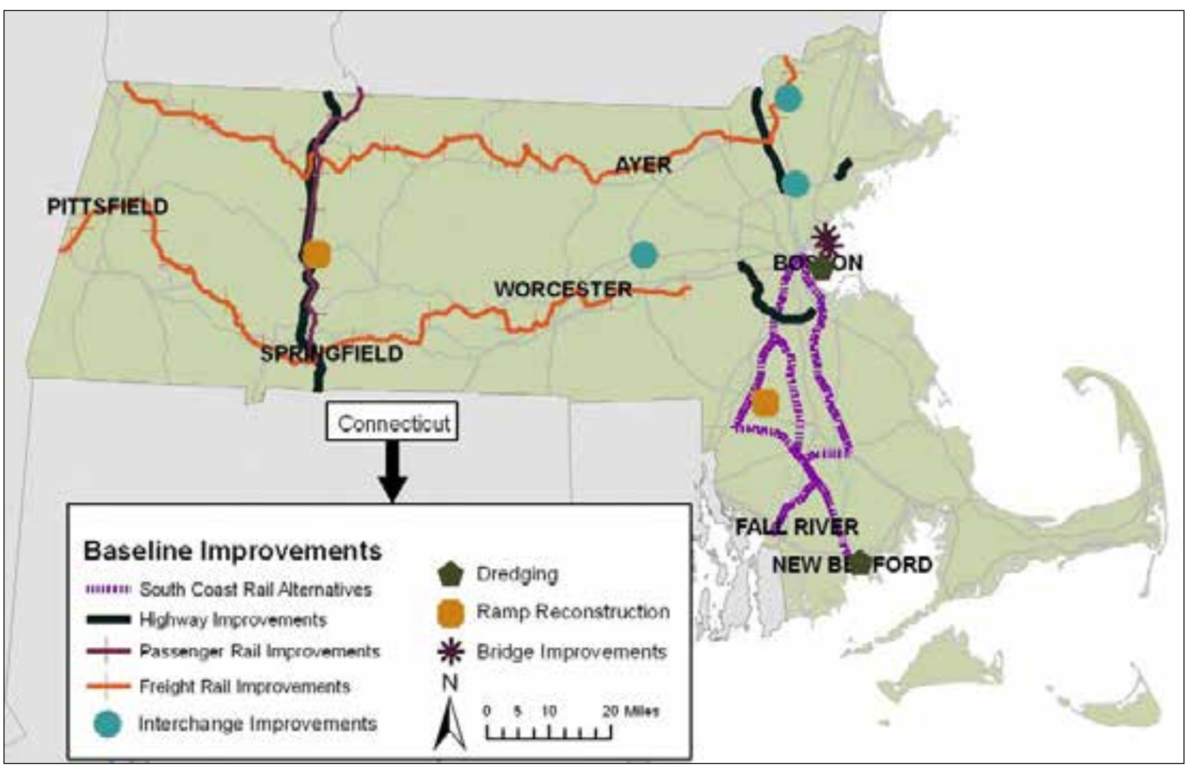
This section presents findings and analysis of each of the five investment scenarios, including maps that detail the project investments comprising each scenario. The scenarios assume a combination of near-term and longer-term investment strategies. Chapter 4 of the technical reports provides a complete discussion of the investment scenario analysis methodology and results.

Baseline Scenario of Planned Freight Transportation Improvements

As discussed briefly earlier and shown below, there are a number of important transportation improvements either on-going or planned for completion within the next 5 to 10 years. This map and the corresponding projects provide a "baseline" of transportation improvements that are assumed to be moving forward toward implementation. The ongoing and planned improvements that are most relevant to the freight system are the CSX east-west double-stack project from the New York border through Worcester to Westborough and the Pan Am Southern Patriot Corridor 286k pound weight-on-rail upgrade. The baseline also includes dredging activities to maintain existing depths at key Massachusetts ports, MassDOT acquisition of CSX properties, I-95/Route 128 widening, I-91 ITS improvements, Knowledge Corridor rail improvements on the Connecticut River Line, and the South Coast Rail Project. It also includes major interchange improvements at I-495 and I-290, I-95 and I-93 north of Boston, and I-495 at Marston Street. Ramp reconstruction projects include I-91 in Northampton and the I-495 South on-ramp from Route 40.

The investment scenarios that follow have as an assumption that these baseline projects are in place and are part of the existing transportation network.

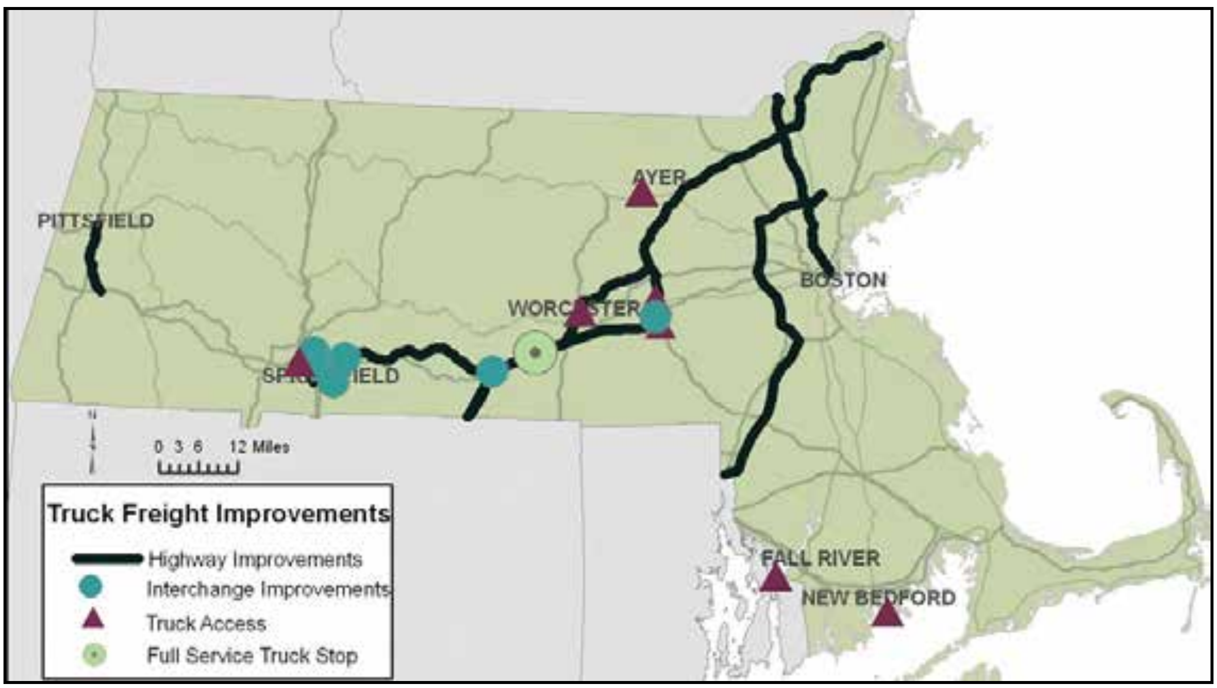
Baseline of Anticipated Massachusetts Transportation Improvements



3.2.1 TRUCK FREIGHT IMPROVEMENTS

The Truck Freight Improvements is a scenario that is designed to test the costs, benefits, and impacts of an approach to freight investment that relies on the highway capacity improvements that would be necessary to significantly relieve highway congestion on the major freight corridors of the Commonwealth. It is intended as a "what if" highway only based scenario. It is important to note that the elements of the truck mode optimization contain planned projects and changes to the highway system that are not planned and therefore should not be viewed as a recommended built-out plan.

The capacity improvements are along the major Interstate facilities including I-90, I-84, I-290, I-495, I-95, and I-93. In addition, the scenario includes improvements to key system bottleneck interchanges with substandard operations. The scenario also includes truck access improvements to freight rail yards and seaports. Improvements to the interchanges primarily consist of lengthening and widening ramps, rebuilding bridges and reconstructing existing toll plazas. The scenario analysis assumes that these projects will be constructed and completed from 2014 to 2024 with total capital costs of approximately $7.3 billion ($4.7 billion in present value). The map below shows the lane additions and other improvements necessary along the key freight highway corridors.



Estimated Annual Transportation Benefits in 2035

Transportation Benefit	
Reduced Truck VHT	4.2 million/year
Reduced Auto VHT	48.2 million/year
Increased Truck VMT	54.1 million/year
Increased Auto VMT	599.5 million/year

Source: HDR calculations

This scenario is by far the most expensive of the five investment scenarios. The costs associated with it far exceed the resources of the federal and state funding expected to be available. This scenario was included primarily to act as a comparison to the following multi-modal scenarios. The improvements would provide congestion relief on some of the Commonwealth's most traveled highway corridors and thus are estimated to generate the largest total benefits at $5 billion. The estimated benefit-cost ratio is 1.04, which means that benefits are only slightly greater than costs of the improvements. Most of the benefits are related to congestion relief for autos (auto VHT reduction is 12 times greater than the truck VHT reduction). There is also some benefit for truck congestion relief and freight logistics, though this benefit is much smaller than the benefit that is afforded to automobile travel. By providing additional highway capacity, this scenario would also facilitate new development outside of developed areas. This in turn would result in longer trips and greater greenhouse gas emissions, contrary to the GreenDOT policy goals of reducing greenhouse gas emissions and supporting smart growth development.

The Truck Freight Improvements are seven times greater than all of the other scenarios combined with correspondingly larger economic impacts. These economic impacts should be considered along with the high capital costs and potential difficulties financing such a large investment. Based on the scenario assumptions and the model analysis, the near term construction activity is expected to create approximately 2,757 jobs annually and produce $165.5 million in new wages per year. The long-term operations and maintenance activity and the cost savings associated with this investment scenario are projected to produce approximately 4,307 additional jobs annually by 2035 with business output increasing by $587 million.

Cost-Effective Investments Based on Preliminary Analysis

While the focus of this analysis is on the entire investment scenario, preliminary analyses of the individual projects that comprise the scenario provide some indication of the relative benefits of each investment opportunity. For the Truck Optimization Scenario, project investments that are estimated to provide the greatest long-term return on investment include:

- Improvements to key system interchanges including I-90 & I-91, I-290 & I-495, and I-90 and I-84.

From this scenario it can be seen that highway improvements generally have benefits for both passenger vehicle users and freight users. Thus, to maximize benefits for a potential transportation project, freight benefits should be considered when evaluating any highway improvement.

3.2.2 NORTHERN TIER RAIL IMPROVEMENTS

The Northern Tier Rail Improvement investment scenario consists of:

- 286k weight-on-rail upgrades to rail corridors connecting to/from the Patriot Corridor;
- Second generation double-stack clearance (to handle maximum height containers) from Mechanicville, NY to the New Hampshire border via the Patriot Corridor; and
- An enhanced intermodal facility in Ayer to facilitate truck-rail transfers of containers.

These projects are anticipated to be constructed between 2010 and 2014 at a cost of approximately $100.6 million ($89.4 in present value terms).

The analysis estimated that this scenario's investments would result in about 500,000 additional tons of intermodal (IM) tonnage carried by rail, and almost 1 million tons of new rail carloads would serve Massachusetts. This would reduce shipping costs to Massachusetts' businesses and reduce truck travel along parallel roadways like Route 2.

Estimated Annual Transportation Benefits in 2035

Transportation Benefit	
IM Freight Rail Volumes (Truck to Rail)	30% increase, 504,000 tons/year
Rail Carloads (Truck to Rail)	9% increase, 387,000 tons/year
Induced Freight Rail Customer Shipping	585,000 tons/year (IM and Carload)
Reduced Truck VMT	6.2 million VMT in MA, 59.4 million VMT in US

Source: HDR calculations

For this scenario, the projected NPV is almost $255 million over the forecast time period and the benefit-cost ratio is estimated to be 3.7. That means that each dollar of investment returns $3.70 in benefit to Massachusetts as well as shippers and receivers regionally and nationally.

The economic impacts can be summarized into the near term which cover the construction and maintenance impacts, while the long term represent the operational impacts of the investments. The construction of the Northern Tier Rail Improvements is expected to create approximately 147 short term jobs per year, and create up to 100 long term jobs annually by 2035. Cost savings for Massachusetts based businesses is estimated to increase business output (or sales) by $23.4 million in 2035.

Cost-Effective Investments Based on Preliminary Analysis

For this scenario, project investments that are estimated to provide the greatest long-term return on investment include:

- Providing second generation double-stack clearance from Mechanicville, NY to Ayer and then to the New Hampshire border, as well as linking Ayer to Worcester to allow double-stack network connections to both class 1 railroads in Massachusetts. Capital costs for these improvements are estimated to be $39.4 million with over $30 million of that for the Mechanicville to Ayer segment, which includes the Hoosac Tunnel.

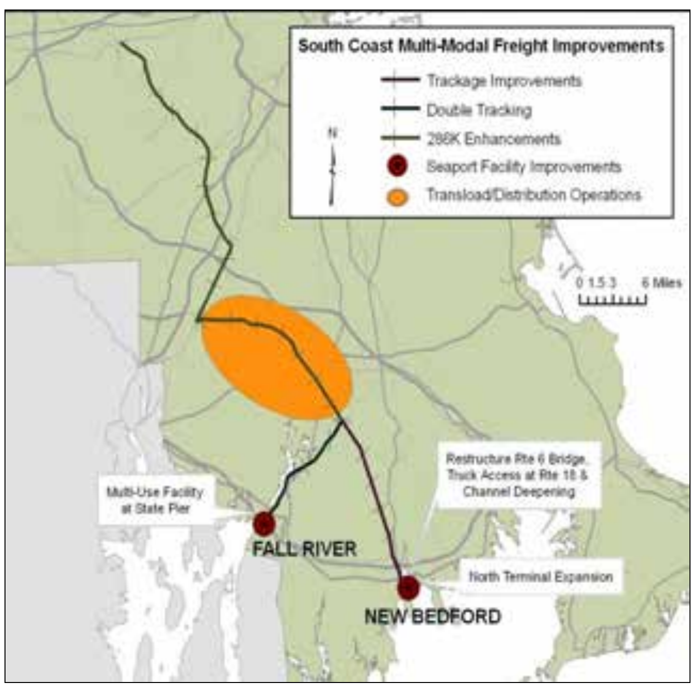
- Extending 286k weight-on-rail capacity connections from the Patriot Corridor from Ayer to Maine and from Ayer to Worcester. Capital costs for these improvements are estimated to be just over $30 million, with about $7 million for the Ayer-Worcester project.

3.2.3 SOUTH COAST MULTI-MODAL FREIGHT IMPROVEMENTS

The South Coast Multi-Modal Freight Improvements investment scenario consists of:

- Marine terminal facility improvements at the Fall River State Pier and expansion of the New Bedford North Terminal;
- Navigational dredging projects in New Bedford;
- Improved truck access to New Bedford via Route 18 and JFK Highway improvements and a reconstructed Route 6 bridge to allow larger ships access to the North Terminal;
- 286k weight-on-rail capacity enhancements from the CSX Boston Line from Framingham south to the Taunton area; and
- Other track improvements to Fall River and New Bedford (coordinated with the South Coast Rail project); and
- Expanded transload and distribution center operations in the region to handle, warehouse, and exchange goods between rail and truck.

These projects are anticipated to be constructed between 2010 and 2018 at a capital cost of approximately $158 million ($126.5 in present value terms), not including operating and maintenance costs.



These improvements are expected to lead to greater marine cargo shipping to Fall River and New Bedford, as the ports take advantage of the better facilities and landside connections to capture future growth in short-sea and coastal shipping. This leads to both shipping costs benefits and reduced truck VMT between Massachusetts and the ports in New York/New Jersey or Halifax. The 286k rail improvements are expected to increase future goods movement by rail, but it should be noted that even with the gains shown in the table, the vast majority of freight is still expected to be shipped by truck.

Estimated Annual Transportation Benefits in 2035

Transportation Benefit	
Increased Marine Cargo Throughput	105% increase, 883,900 tons/year
Rail Carloads (Truck to Rail)	45% increase, 830,000 tons/year
Induced Freight Rail Customer Shipping	184,600 tons/year (Carload)
Reduced Truck VMT	7.8 million VMT in MA, 21.6 million VMT in US

Source: HDR calculations

For this scenario, the estimated NPV is a gain of $4.3 million, meaning that benefits exceed cost over the forecast time period, and the benefit-cost ratio is estimated at 1.03. The largest benefits are expected to include over $100.9 million in shipper cost savings and $10.8 million in reduced highway maintenance.

In the near term, construction activity is estimated to create approximately 343 jobs annually in the Commonwealth and produce $20.1 million in new wages. The long-term (2035) operations and maintenance activity will produce approximately 50-60 jobs per year with $3.5 million in annual wages and $11.5 million in business output due to cost savings.

Cost-Effective Investments Based on Preliminary Analysis

The project initiatives in the South Coast Multi-Modal Freight Improvements Scenario that indicate a positive return on investment include:

- Upgrading the rail corridor from Framingham on the CSX Boston Line to the region's core, with coordinated track improvements to Fall River and New Bedford to allow effective shared use rail connections to the ports. These rail improvements are estimated to cost approximately $20 million.
- The New Bedford North Terminal expansion project with associated port improvements (dredging, bridge clearance) is estimated to cost $76 million with 8,500 tons of cargo per $1 million in investment and a positive return on investment.

It should also be noted that supporting projects such as a transload facility in the region, navigational dredging projects, and highway access improvements to New Bedford may be critical to achieve the marine cargo shipping market gains estimated in this scenario.

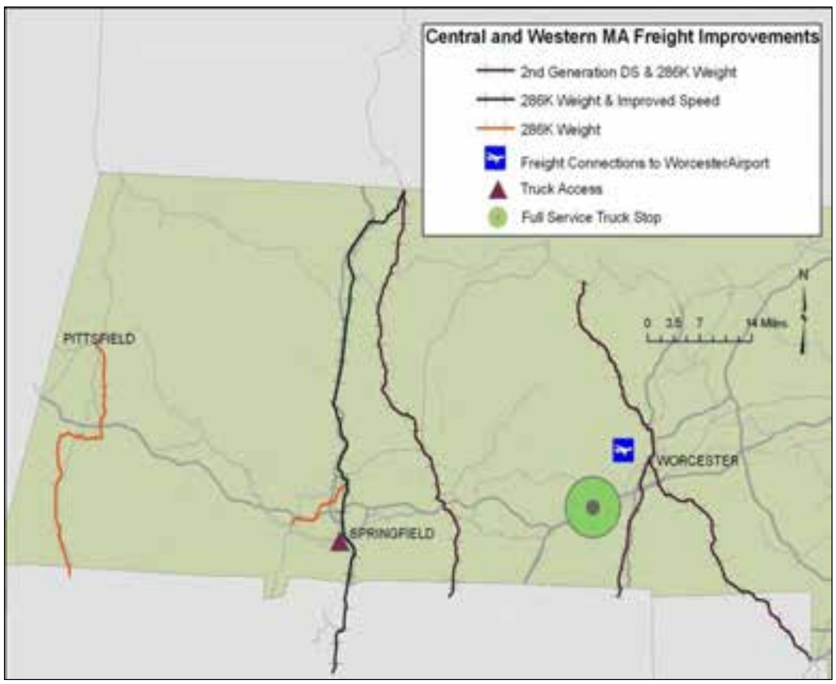
3.2.4 CENTRAL AND WESTERN MA RAIL IMPROVEMENTS

The Central and Western MA Rail Improvements investment scenario consists of:

- Upgrades to 286k weight and Second Generation double-stack clearance on the north-south rail corridors in the region (New England Central Railroad and Providence & Worcester);

- 286k weight-on-rail and improved speeds on the Pan Am Connecticut River Line (coordinated with the planned Knowledge Corridor passenger rail improvements);
- 286k weight-on-rail upgrade on the Pioneer Valley Railroad and Housatonic rail corridors;
- Improved truck access to the West Springfield intermodal facility and the Worcester Airport; and
- A new truck stop facility along I-90 between Worcester and the I-84 interchange.

These projects are anticipated to be constructed between 2010 and 2014 at a capital cost of approximately $74.2 million ($66.1 in present value terms). These rail corridors provide critical goods movement connectivity to regional markets such as Montreal, Providence, and the New York/New Jersey region. The improved north-south rail corridors, connecting to/from the CSX Boston Line and the Patriot Corridor, enable improved freight rail operations, lower costs, and greater future freight volumes handled by rail rather than truck.



The scenario improvements are anticipated to increase intermodal shipments but the total increase in freight volumes is larger for bulk carload shipments since the majority of freight traffic on these corridors is a mix of bulk carload shipments. The total rail tonnage increase is estimated to be almost 1.4 million tons.

Estimated Annual Transportation Benefits in 2035

Transportation Benefits	
IM Freight Rail Volumes (Truck to Rail)	30% increase, 136,500 tons/year
Rail Carloads (Truck to Rail)	21% increase, 824,900 tons/year
Induced Freight Rail Customer Shipping	442,760 tons/year (IM and Carload)
Reduced Truck VMT	15.5 million VMT in MA, 36.8 million VMT in US

Source: HDR calculations

For this scenario, the estimated NPV is approximately $143 million over the forecast time period and the benefit-cost ratio (BCR) is estimated to be 3.1 meaning that benefits are 3.1 times greater than costs, a BCR similar to the Northern Tier Scenario.

The Central and Western MA Rail Improvements investment scenario has the lowest capital costs out of all the scenarios. The near-term construction activity is expected to create approximately 104 jobs and produce $7.8 million in new wages annually. Additionally, the long-term (2035) operations and maintenance activity and large cost savings associated with this investment scenario are estimated to produce approximately 77 jobs per year with $4.6 million in annual wages and business output of approximately $15.5 million.

Cost-Effective Investments Based on Preliminary Analysis

This scenario's most promising investment projects from a return on investment basis are:

- Providing second generation double-stack clearance on the Providence & Worcester Railroad, where the key bottleneck is on the Norwich Branch, is estimated to provide a strong return on investment given a relatively low capital cost ($1.8 million) and relatively strong freight rail market gain (135,000 tons).
- 286k weight-on-rail upgrades to the Pioneer Valley Railroad and the Providence & Worcester Railroad corridors are estimated to have a large benefit, followed by the New England Central Railroad and Pan Am Railroad 286k weight-on-rail upgrades.

3.2.5 BOSTON CORE MULTI-MODAL FREIGHT IMPROVEMENTS

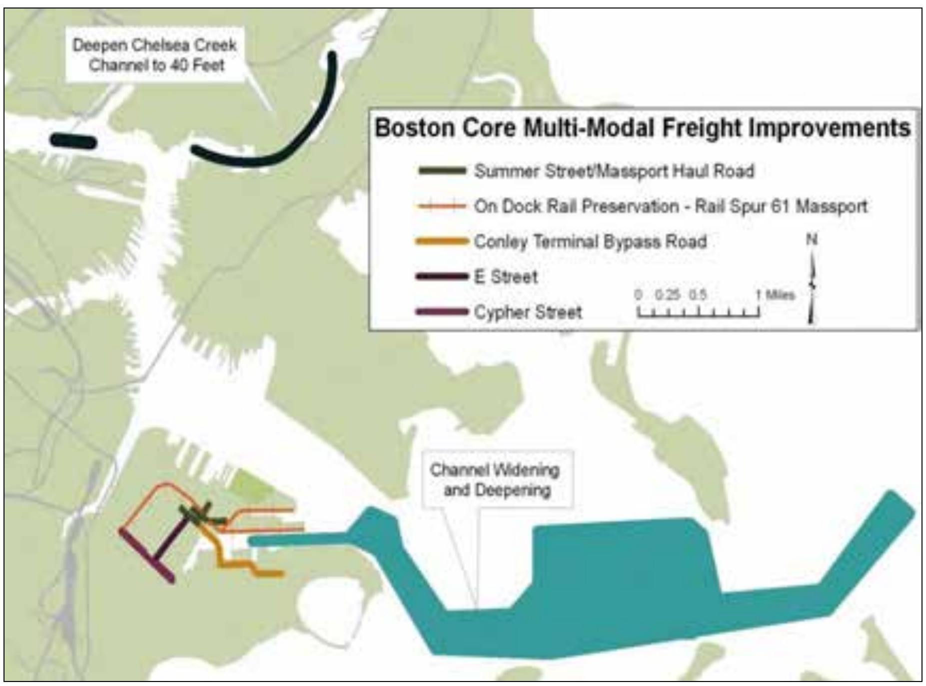
The Boston Core Multi-Modal Freight Improvements investment scenario consists of:

- A number of roadway improvement projects connecting to the Port of Boston in South Boston including:
    - A one mile dedicated truck haul road for Conley Terminal from Farragut Road to Summer/L Street;
    - Extension of Cypher Street from D Street, across E Street and rejoining with Pappas Way;
    - The reconstruction of E Street to become the primary north-south truck connector for the area south of Summer Street; and
    - New connections between Summer Street and the Massport Haul Road realigning Pappas Way to accommodate a development parcel.
- A major deep draft navigational project providing greater marine shipping capacity at Conley Terminal and deeper channels near Charlestown, East Boston and Chelsea;

- On-dock rail preservation for Track 61 providing rail access to the planned bulk cargo facilities at North Jetty; and
- Policy and regulatory initiatives for heavy load truck routing from the Port to inland distribution centers and preservation of freight and industrial land uses near Logan Airport (e.g., Rt. 1A in Lynn) and South Boston.

These projects are anticipated to be constructed between 2012 and 2016 at a capital cost of approximately $358.4 million ($286.4 in present value terms).

The Boston Core Multi-Modal Freight Improvements scenario focuses on enhancing goods movement to and from the Port of Boston, centered on a major deep draft navigation project which has been studied extensively by Massport and the Army Corps of Engineers.[14] The major port improvements will be the deepening and widening of the main navigation channel to Conley Terminal to better accommodate larger vessels and improvement dredging to deepen the Chelsea Creek to 40 feet to allow larger oil tanker vessels to enter. Planned roadway improvements in South Boston are expected to provide more efficient truck routes as well as increased safety for passenger travel in the area, and the Track 61 rail project would provide on-dock rail to a planned bulk cargo facility. No direct rail connection to Conley container port is planned.



This scenario provides an estimated NPV of $125.8 million over the forecast time period and the third largest benefit-cost ratio at an estimated 1.4. The largest projected benefits accrue through shipper cost savings from shifting freight from truck to the marine system. Other significant benefits are expected to include $28.4 million in truck congestion relief benefits and $31.1 million in congestion relief benefits to autos.

[14] Boston Harbor Deep Draft Navigation Improvement Study, Draft Feasibility Report (EOEA #12958), US Army Corps of Engineers, April 2008.

Estimated Annual Transportation Benefits in 2035

Transportation Benefits	
Increased Marine Cargo Throughput	107% increase, 2.9 million tons/year (86,400 TEUs)
Increased Rail Carloads	2,070 carloads/year
Reduced Truck VMT	11.6 million VMT in MA, 65.5 million VMT in US

Source: HDR calculations

The near-term construction activity is estimated to create 190 jobs and produce $11.8 million in new wages per year. Although the investment into the port will be quite large, a significant portion of the investment will be in equipment and materials purchased outside the region. The long-term operations and maintenance activity and shipper cost savings associated with this investment scenario is expected to increase economic competitiveness and produce approximately 86 jobs per year with $5.1 million in annual wages, and an additional $17.1 million in business output.

Cost-Effective Investments Based on Preliminary Analysis

This scenario's most promising investment projects from a return on investment basis are:

- The deep draft navigational project at the Port of Boston is estimated to cost $308 million and is thus well beyond the resources of Massport without significant federal and/or state funding.
- The South Boston roadway improvements including construction of a new Conley Terminal Freight Bypass Road and upgrades to Cypher Street and E Street, a package that totals just over $40 million in capital expenditures.
- The multi-phase Track 61 rail project has a total cost of $9.5 million and is likely the only near-term chance at the Port of Boston for on-dock rail access (to a planned bulk cargo facility at the North Jetty).

3.2.6 FUEL PRICES

Fuel prices are a significant and growing factor in transportation costs, and they impact the cost for producers as well as consumers. After 2005, diesel fuel prices began to rise, leveling off in early 2007, and then dramatically increasing to over $4.50 a gallon during the summer of 2008. Since then, diesel fuel prices have declined to just below 2004 prices. The prices are again increasing but a more moderated rate. The combination of high fuel prices and the onset of economic recession placed significant pressure on the freight industry and businesses, reducing freight tonnages and affecting modal shipping choices. Because of this recent volatility in fuel prices, an analysis was done to assess the sensitivity of the investment scenario analysis to the affect of fuel prices.

Monthly Retail Diesel Fuel Prices

Source: Energy Information Administration (EIA)

The analysis of increasing fuel prices on mode choice was based on fuel prices tracking 50 percent above inflation. For each 10 percent increase in truck shipper cost, 8 percent of truck volumes were reduced.[15] Overall, 39 percent of long-haul shipments were diverted to rail for each scenario to determine the impact high fuel prices would have on truck diversion. The estimated increases in the BCR for each multi-modal scenario are:

- The Northern Tier Scenario's BCR increases from 3.7 to 4.2
- The Southeastern Massachusetts Scenario's BCR increases from 1.0 to 1.4
- The Central-Western Scenario's BCR increases from 3.1 to 3.7
- The Boston Distribution Network Scenario's BCR increases from 1.4 to 2.0

The results demonstrate that diesel prices could have a significant impact on shipper costs and congestion relief that would increase the BCR for each investment scenario.

3.3 SUMMARY FINDINGS OF INVESTMENT SCENARIOS

The analysis of investment scenarios and the individual projects that comprise each of them are helpful in assessing priorities and strategies for the Commonwealth to improve goods movement. A detailed table and a graph of cost-benefit analysis results are presented below along with estimates of greenhouse gas emissions impacts for each multi-modal scenario.

[15] Victoria Transport Policy Institute (VTPI), "Transportation Demand Management (TDM) Encyclopedia."

Cost-Benefit Analysis Summary of Freight Investment Scenarios

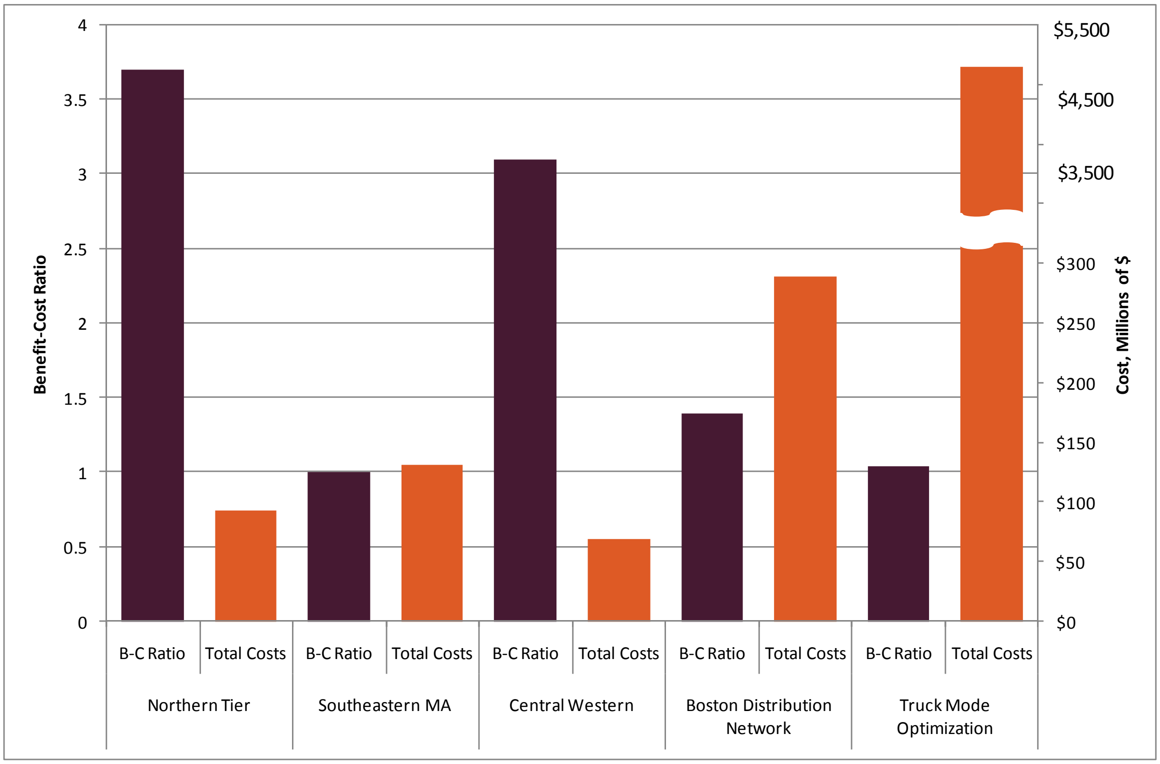
	Truck Freight	Northern Tier Rail	South Coast Multi-Modal	Central and Western MA Rail	Boston Core Multi-Modal
Shipper Cost Savings	N/A	$315.2	$100.9	$131.6	$310.1
Truck Congestion Relief Benefits	$607.1	$2.2	$5.3	$18.8	$28.4
Freight Logistics Benefits	$433.0	$1.6	$3.8	$8.2	$20.3
Economic Benefits & Cost Savings	**$1,040.1**	**$319.0**	**$109.9**	**$158.6**	**$358.8**
Auto Congestion Relief Benefits	$4,510.9	$14.9	$10.7	$27.9	$31.1
Reduced Emissions	($194.0)	$1.8	$0.8	$0.8	$3.0
Reduced Accidents	($61.5)	$2.8	$3.2	$5.7	$5.2
Reduced Highway Maint. and Repair	($212.8)	$9.4	$10.8	$19.2	$17.6
Transportation & Environmental	**$4,042.7**	**$28.9**	**$25.4**	**$53.6**	**$56.8**
TOTAL BENEFITS	**$5,082.8**	**$347.9**	**$135.4**	**$212.2**	**$415.6**
Capital Costs	$4,763.6	$89.4	$126.6	$66.1	$286.5
O&M Costs	$136.6	$3.8	$4.5	$3.1	$3.3
TOTAL COSTS	**$4,900.2**	**$93.2**	**$131.1**	**$69.2**	**$289.7**
Net Present Value (NPV)	**$182.6**	**$254.7**	**$4.3**	**$143.0**	**$125.8**
Benefit-Cost Ratio	**1.0**	**3.7**	**1.0**	**3.1**	**1.4**

Source: HDR and EDR Group calculations

The findings suggested by the scenario analysis include:

- Although all five of the investment scenarios are estimated to have a positive return on investment (a benefit-cost ratios at or above 1.0), the Central and Western MA Rail and Northern Tier Rail scenarios showed the benefits to costs with a BCR above 3.0.

Benefit-Cost Ratio and Capital Costs by Investment Scenario



Source: HDR and EDR Group calculations

- The Truck Freight Improvements scenario showed a net benefit with a BCR of 1.04 but also presents challenges as it is by far the most expensive option that exceeds all expected federal and Commonwealth funding. It also would induce highway travel. This in turn would increase greenhouse gas emissions, creating conflict with federal clean air standards and the recently established state target carbon reductions through Chapter 21N, the Global Warming Solutions Act (GWSA). Additionally, any project delays, environmental permitting issues, or other project financing complications could easily increase the costs above the overall benefits. It is important to note that highway improvements generally have benefits for both passenger vehicle users and freight users. Thus freight benefits should be considered when evaluating any highway improvement.
- Overall, the investment scenario results clearly show that investment intended to improve goods movement, even on privately owned assets, has both public and private benefits through reduced travel time, improved levels of congestion, reduced maintenance of publicly-owned infrastructure, and reduced emissions. These benefits demonstrate the potential benefits to be realized through public/private partnerships.
- The investment scenarios shifting freight from truck to rail or water will reduce overall mobile emissions. The table below shows the reduction Greenhouse Gases (GHG) in tons for each multi-modal scenario. The truck mode optimization scenario significantly increases the amount of GHG emissions.

Greenhouse Gas Impact by Investment Scenario

Scenario	Tons of GHG
Northern Tier Rail Improvements	(2,640)
South Coast Multi-Modal Freight Improvements	(1,070)
Central and Western MA Rail Improvements	(1,350)
Boston Core Multi-Modal Freight Improvements	(3,120)
Truck Freight Improvements	1,005,480

Source: HDR calculations based on EPA data

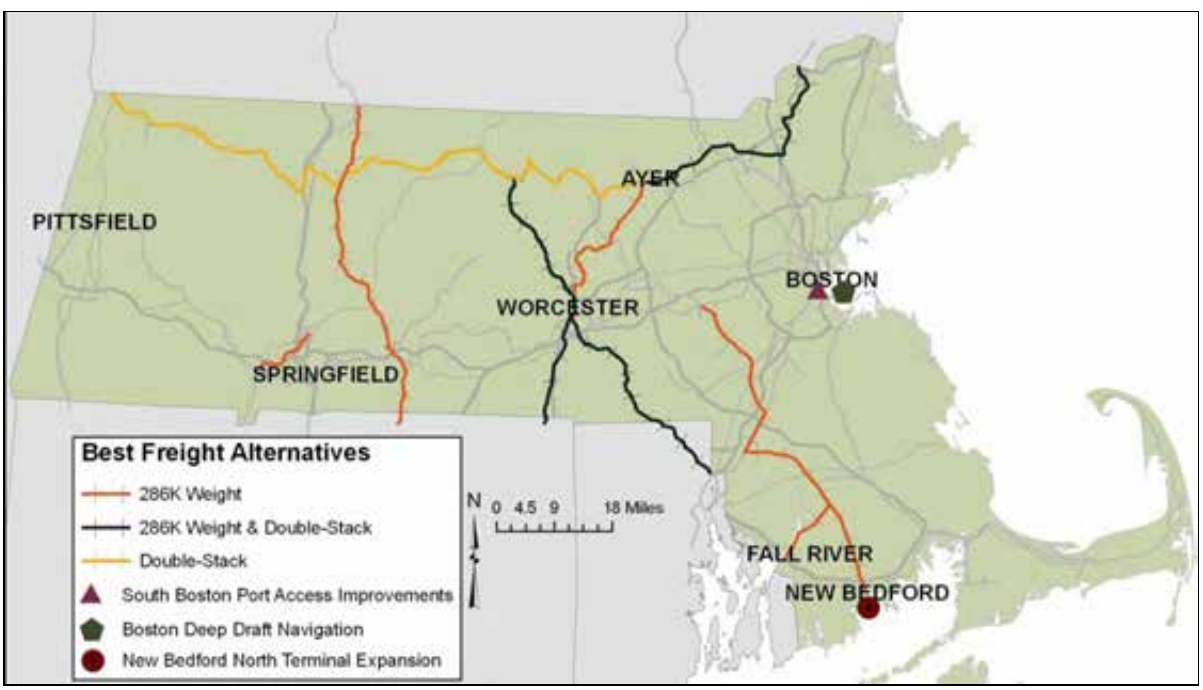
4 Freight Plan Findings and Recommendations

The Freight Plan findings and recommendations are organized in terms of investment opportunities with a high expected return on investment and policy issues and recommendations to support a more competitive freight system in Massachusetts.

4.1 FREIGHT INVESTMENT PRIORITIES – HIGH RETURN PROJECTS

For each of the previous scenarios, individual projects demonstrated strategic benefits paired with high return on investment (ROI). The projects from each scenario that are estimated to provide the best return on investment and strategic transportation advantages were have been identified. These multimodal projects enhance current freight service and capitalize on current infrastructure to facilitate network level efficiencies. The majority of these investments are centered on the rail network, improving both east-west movements and north-south connections. Rail improvements include both 286k weight-on-rail capacity and double-stack clearance improvements. Additionally, the expansion of New Bedford's north marine terminal and the deep draft dredging project for Boston Harbor are included, with additional landside improvements to the South Boston roadway network. The highest return projects are shown in the map below.

Freight Investment Projects with the Highest Estimated Return on Investment



The freight projects with the highest estimated ROI include:

Project Name	Investment
Mechanicville to Ayer	Double-stack
Ayer to Maine	Double-stack & 286k
Worcester to Ayer	286k
PVRR Westfield to Holyoke	286k
NECR (VT border to CT border)	286k
P&W (Worcester Connections)	Double-stack & 286k
Framingham to Taunton (CSX)	286k
Taunton to NB & FR	286k
Boston Harbor	Deep Draft Dredging
South Boston Port Access	Road
New Bedford North Terminal Expansion	Harbor Freight Terminal

The total cost of the high ROI investments, in present value terms, is $402.9 million. Reduced shipping costs from transporting more freight by lower cost rail and water modes provide the largest benefits. These projects would enhance the competitiveness of the Massachusetts economy, reduce consumer costs to residents, and provide environmental benefits. These projects also provide significant roadway congestion benefits to both trucks and autos, resulting in reduced emissions and accident costs. Transportation and environmental benefits account for 10 percent of the total benefits. Other benefits include a $49.1 million reduction in highway maintenance costs, and $24.6 million in freight logistics benefits.

High ROI Investment Projects Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$783.7
Truck Congestion Relief Benefits	$76.4
Freight Logistics Benefits	$24.6
Economic Benefits & Cost Savings	**$884.7**
Auto Congestion Relief Benefits	$28.9
Reduced Emissions	$5.9
Reduced Accidents	$14.5
Reduced Highway Maintenance and Repair	$49.1
Transportation & Environmental	**$98.3**
TOTAL BENEFITS	**$983.0**
Capital Costs	$393.3
O&M Costs	$9.6
TOTAL COSTS	**$402.9**
Net Present Value (NPV)	**$580.2**
Benefit-Cost Ratio	**2.4**

Source: HDR and EDR Group calculations

The overall estimated benefit-cost ratio is 2.4, a very strong return on investment. Of note, these benefit results are based on the assumption that diesel fuel prices escalate in-step with overall inflation growth. As discussed above, if fuel prices do increase faster than overall inflation, the benefits of these multi-modal freight investments are expected to be even higher, with greater diversion of future freight growth from truck to rail and water modes. The BCR for this higher fuel price condition would likely be between 2.7 and 3.0.

It's worth noting that approximately 90 percent of the estimated benefits would accrue to private sector economic activity as the transportation improvements reduce the costs and boost the efficiency of goods movement for freight shippers, receivers, and carriers. These impacts improve the economic competitiveness of Massachusetts businesses and contribute to a seamless, multi-modal system of global and domestic trade. Most of the improvements would occur on privately-owned rail infrastructure or at quasi-public seaports. These results highlight the importance of public-private partnerships to implement large-scale transportation improvements to benefit Massachusetts residents and businesses. The recent CSX rail transaction and Knowledge Corridor rail project provide good examples in Massachusetts of public-private partnerships on privately-owned rail lines.

These investment projects, expected to provide a range of benefits to Massachusetts, form a list of priority opportunities for MassDOT to pursue over the next five to ten years. Importantly, it is anticipated that the capital costs to implement these projects will come from a range of federal, state, and private resources. For example, the various freight rail investment present opportunities for public-private partnerships to undertake needed investments. It is anticipated that MassDOT will use the information in the Freight Plan to help guide policy formation and project priorities.

4.2 POLICY ISSUES AND RECOMMENDATIONS

A number of policy issues and recommendations have been identified in the areas of land use development, funding and financing, and the freight planning to best utilize the existing freight transportation system in the Commonwealth and to support potential investments.

4.2.1 LAND USE DEVELOPMENT

Freight movement takes place within a land use context where manufacturers and distributors of goods are located throughout Massachusetts in a variety of settings. These companies make market decisions regarding where to locate their facilities. Key considerations in these decisions are the availability of sites of the requisite size, the availability and quality of freight transportation, and proximity to markets and labor. A significant concern for freight-intensive uses is that other land uses that are not freight dependent often are considered "higher and better uses" for most developable land in the Commonwealth. These other land uses tend to predominate in the real estate market and are typically the target of most economic development initiatives. In addition, freight-intensive uses have size and activity characteristics that are often perceived as incompatible with other land uses. The result of this combination of economic development focus and perceptions is that land served by rail and originally zoned for freight-intensive uses is being rezoned for other uses. The loss of land for freight-intensive uses results in increased shipping costs and reduced competitiveness for the Commonwealth's economy.

The following items are specific recommendations for further development and action.

Freight-Intensive Land Use Policy

A policy on freight-intensive land uses should be adopted by MassDOT and the Executive Office of Housing and Economic Development that articulates the Commonwealth's interest in preserving land for freight-intensive uses and developing parcels in a manner that does not foreclose rail access. This policy would define freight-intensive use and set forth criteria for determining if a parcel is of strategic importance for these uses. The policy and its criteria would be used to:

- Develop a statewide inventory to identify major parcels of strategic statewide importance suitable for intermodal centers, distribution/assembly centers, or freight villages, as well as in evaluating local industrial-incentive areas (described below) that are proposed by municipalities. As mentioned earlier, the current list of Priority Development Sites does not include any sites expected to include freight-intensive uses, and this action would thus create a limited number of strategic statewide sites for freight-intensive use.
- Explicitly include freight-intensive uses as eligible elements of Chapter 43D Priority Development Sites, and as qualifying uses under the Growth District Initiative. This could be addressed by having the Interagency Permitting Board under Chapter 43D make a simple revision to its guidelines to address freight-intensive use. Maintaining rail access would become a requirement for such parcels under both programs.

This policy would be considered in MEPA review in a manner similar to the Commonwealth's ten sustainable development principles and would be instrumental in pre-review under MEPA (described below). This aspect of the policy should be articulated through development guidelines for parcels with rail access. The guidelines could also be adopted by local planning boards as part of their subdivision regulations where applicable.

Statewide Inventory of Sites

In order to target specific sites for a freight-intensive use policy, MassDOT and EOHED in collaboration with their partners, including MassDevelopment and MassEcon, should identify sites of at least 10 acres suitable for large-scale freight uses such as intermodal and/or large distribution facilities. The inventory should also identify a second tier of smaller sites that have good multi-modal transportation access and can support freight-intensive uses that contribute to the Massachusetts economy. MassEcon has begun similar work by engaging with the Massachusetts Railroad Association to qualify rail-served sites from their SiteFinder database. Completing this work with input from the railroads and economic development officials would provide a strong foundation the inventory of sites.

Freight-Intensive Land Use Development and Preservation

Many parcels of the size, location, amenities, and access characteristics suitable for freight rail operations are currently threatened by development that could threaten their freight use. For example, many of these parcels are simply being converted or rezoned to non-industrial use. Others are being reduced to a size that is not adequate for freight uses due to "encroachment" of other land uses. Still others are being isolated by development that blocks access to the freight transportation network. Similar issues occur on waterfront parcels in or near ports, although these areas often enjoy greater regulatory protections, such as Designated Port Areas and Chapter 91 regulations, than rail-accessible parcels.

Planning for freight-oriented land use and recognition of the essential role that freight and logistics support plays in a modern and sustainable 21st century economy are largely discounted at the local level, and have often been undervalued at the broader state and regional levels.

Current MGL Chapter 40 programs do not include explicit considerations for the range of freight activity required to support and sustain these development trends.

A successful program to emulate for freight-intensive land use preservation is the existing MGL Chapter 40L, Agricultural Incentive Areas. The Plan recommends that legislation be adopted to allow for an "Industrial Incentive Area" statute. The new statute would keep land use responsibility at the local level, giving the Commonwealth and municipalities the option to designate industrial land suitable for freight-intensive uses as an "Industrial Incentive Area." Once the statute has been adopted and the parcel designation has been approved by a 2/3 vote of the municipal legislative body, sale, or conversion to non-industrial use would require notice from the owner, and the municipality (or state) would have a first option to purchase the property at its appraised full market value. Like Chapter 40L, the rationale is that designation of a parcel as an incentive area allows land to remain in a desirable land use under private ownership, but allows the public sector to acquire a parcel before its use is changed.

Pre-Review of Freight-Intensive Development Under MEPA

Preserving freight-intensive land uses across the Commonwealth would help reduce air emissions and their associated pollutants. This result is in line with many of the goals of MEPA. MassDOT should work with the Executive Office of Energy and Environmental Affairs to develop a streamlined MEPA process for freight-intensive development. In particular, a major freight-intensive development such as a freight village or a distribution site with multiple parcels or phases could be reviewed through a Generic EIR that anticipates key impacts related to the development. This would streamline the environmental process as individual parcels or phases could be quickly and easily reviewed if their characteristics fit within the envelope of impacts established by the GEIR. Depending on the specific situation, a series of Notices of Project Change could be used to address these implementation stages. Alternatively, a Special Review Process could be employed that characterizes impacts and appropriate mitigation commitments for the overall development, with expedited review of successive implementation stages as final development plans are solidified for the parcels within the overall master plan.

4.2.2 FUNDING AND FINANCING

A critical element of improving the Commonwealth's freight transportation infrastructure is determining practical and innovative mechanisms to finance improvements. Key recommendations include:

- Greater consideration of goods movement in funding allocations
- Strategic multi-modal investments in projects of statewide significance
- Creation of an industrial rail access program (IRAP)
- Increased public-private partnership opportunities and funding.

See Chapter 5.1 of the technical reports for a complete freight funding and financing assessment.

Greater Consideration of Freight in Transportation Funding Decisions

As demonstrated herein, there is a significant need for infrastructure improvements targeted at goods movement, along with significant public benefits of more efficient, cost-effective, and environmentally-friendly freight. Traditionally, transportation funding decisions, have only considered freight in an indirect manner. This study has compiled data on freight activity for all key facilities and developed a series of data-oriented measures to track freight system performance in Massachusetts. MassDOT will incorporate these key infrastructure condition and performance metrics developed as part of the decision-making process for future transportation investments.

Strategic Multi-Modal Investments

The recent reorganization of the transportation agencies in Massachusetts completes the evolution of state transportation from a highway-focused organization to a true multi-modal transportation agency. Consistent with this evolution and supported by the analysis findings in this plan, there are significant public benefits to be achieved from multi-modal investments in rail, seaport, aviation, and intermodal facilities. The Commonwealth's traditionally modest direct funding to these non-highway modes is increasingly falling behind other states regionally and nationally. This could be accomplished through a new dedicated funding mechanism within the Commonwealth budget, and/or targeting specific multi-modal investment projects that are expected to generate significant public benefits.

Increased Use of Public-Private Partnerships

A major theme of the Freight Plan is that targeted and prioritized freight transportation investment results in both public and private sector benefits for the Commonwealth. To realize the benefits projected in the Freight Plan, the Commonwealth can more proactively partner with the private sector on mutually beneficial projects by sharing the upfront capital costs. This is especially true for the rail system. Historically, Massachusetts has encountered substantial policy and legal constraints on its ability to engage in true shared investment for shared benefit arrangements in the Commonwealth's rail network. However, MassDOT, with a strong legislative finding and specifically authorized program, similar to programs in other states, could broaden the range of potential rail investments that deliver public benefits to the Commonwealth. Other states are increasingly using rail funding mechanisms to cover critical corridor and intermodal facility improvements that emphasize private sector matching funds and prioritization of projects based on quantitative evaluation criteria and cost-benefit analysis.

Industrial Rail Access Program (IRAP)

Rail sidings for industrial use are costly to construct, particularly compared to roadway based connections that are inherently a component of an industrial facility. An IRAP would provide funding assistance for the construction or improvement of railroad tracks and facilities to serve industrial or commercial sites where freight rail service is currently needed or anticipated in the future. The funding program can allow financial assistance to localities, businesses, and/or industries seeking to provide freight rail service between the site of an existing or proposed commercial facility and common carrier railroad tracks. The program is a form of public-private partnership and a logical extension of existing Massachusetts programs to enhance economic development such as the Public Works Economic Development (PWED) and the Massachusetts Opportunity Relocation Expansion (MORE) programs.

The benefits of IRAP programs in Maine, New York and other nearby states currently place Massachusetts at a competitive disadvantage for locating industrial companies on rail-served sites. They typically are funded at modest levels (less than $5 million/year) and require significant matching funds from the private sector. Massachusetts' current Freight Rail Funding Program is similar in many ways to an IRAP program except that the program's enabling legislation restricts private companies from using public funds for improvements. In addition, the program has many existing financial obligations, and limited bond capacity. By allowing private companies to use public funds through a new IRAP program these funds could be greater utilized for improvements to privately-owned rail in Massachusetts, thus boosting economic development opportunities and encouraging use of the rail system.

Suggested IRAP requirements should be the inclusion of a competitive grant process with at least 50 percent private matching funds and projects should demonstrate quantitative and qualitative economic benefits such as job creation and retention, and increased state/local tax revenue from the benefiting businesses with mitigation for any impacts on passenger rail services.

Competitive Federal Funding Programs

The American Recovery and Reinvestment Act (ARRA) of 2009 led to new, competitively funded programs such as TIGER (Transportation Investment Generating Economic Recovery) Grants and the High Speed Intercity Passenger Rail (HSIPR) program. While these programs were designed specifically to provide economic stimulus, their success and the overwhelming demand for these funds suggest that similar future rounds of Federal funding and application requirements are likely. Lessons learned from those programs for maximizing funding success are:

- Projects need an existing planning and feasibility analysis.
- Positive cost-benefit analysis and identified sustainable benefits are needed to demonstrate a strong return on investment.
- Commonwealth and local stakeholder support and funding contributions are needed for a project.
- Multi-modal transportation strategies linking freight and transit will do well in programs such as TIGER.
- Projects with coordinated regional and multi-state elements are positively considered.

As Massachusetts was successful in recent TIGER and HSIPR funding applications, it should continue to position its key state and regional transportation investment efforts to be prepared for potential Federal funding opportunities.

4.2.3 FREIGHT PLANNING AND POLICIES

In Massachusetts, there are numerous Commonwealth level regulations that impact freight and passenger common carriers. The majority of these programs are directed at protecting public safety. Virtually all truck routes are owned by state or local governments, and airports and harbors are owned by public authorities. Principal rail lines are mostly privately owned, although in Massachusetts there is considerable public ownership and shared use of rail lines. As a consequence of this mixed ownership and management, most solutions to freight issues require cooperative action by both public and private sectors. Financing, planning, and other institutional mechanisms for developing and implementing joint efforts have been constrained due to the separation of authority and responsibility among the modes and infrastructure ownership/management. Addressing this situation is projected to positively improve performance of the freight system.

MassDOT should engage in effective multi-modal transportation planning and development. To further address the issue of inter-regional coordination of mobility, MassDOT should continue to enhance working relationships with neighboring states and regional planning entities, such as the I-95 Corridor Coalition, and take advantage of the regional cooperation opportunities afforded by active participation in AASHTO's northeast section, Northeast Association of State Highway & Transportation Officials. A recent example of regional coordination is seen with New England's vision for high-speed rail and the follow-up coordination between the states on the pursuit of mutually beneficial rail projects.

The challenge to regional approaches to freight mobility includes the need to prioritize corridor projects that may lie outside of the state borders. This could mean deferring or sharing federal funds. The Pilgrim Partnership between the states of Massachusetts and Rhode Island, which outlines the conditions for operating MBTA commuter rail to Providence, RI, is an example of how such sharing can be mutually beneficial.

MassDOT may also explore establishment of a formal regional transportation organization that would engage the region's states in multi-modal, interstate transportation planning and development. Federal policy development indicates that future federal funding may be tied to regional coordination and multi-modal corridor programs. Massachusetts has already taken steps in this direction with the ongoing efforts with Connecticut and Vermont related to the Knowledge Corridor rail projects. This example is passenger rail related, but the same concepts may be developed to address goods movement.

MassDOT should develop a pro-active truck parking program to enhance freight flows. Trucks are the dominant mode of transportation of freight into, out of and through the Commonwealth. As a result, trucks contribute to highway congestion, greenhouse gas emissions, and congested parking at roadside rest areas. Working with EPA's SmartWay program, MassDOT will explore development of safe and efficient truck stops along the Interstate system that will reduce or eliminate idling, and provide for adequate locations for truck staging.

4.3 TECHNICAL REPORTS

This executive summary represents a compilation of data, trends, findings, analysis, and policy recommendations from the comprehensive evaluation of the freight system in Massachusetts. Support for the executive summary is provided in a series of technical reports. The technical reports can be accessed on the MassDOT web site at:

http://www.mass.gov/massdot/freightandrailplan

1 Freight Plan Overview and Goals

1.1 OVERVIEW OF APPROACH AND METHODOLOGY

The Massachusetts Department of Transportation (MassDOT) recognizes the importance of goods movement to the mobility, economy, and quality of life in the Commonwealth. To fully understand and facilitate the most efficient use of this important aspect of transportation, MassDOT has produced this comprehensive multi-modal Massachusetts Freight Plan (Freight Plan).

Efficient, cost-effective freight movement is an important element of economic competitiveness, especially as domestic and global trade continues to expand. In addition, Massachusetts with its relatively high per capita income is increasingly reliant on the delivery of consumer goods via the freight system and distribution centers. And by its nature, freight operations interact closely with passenger movements whether directly with passenger rail such as Amtrak and commuter services, or indirectly with highways, airports, and seaports.

The purpose of the Freight Plan is to produce a comprehensive evaluation of the Commonwealth's freight transportation system, its operations, and its effect on economic development and quality of life. The plan is multi-modal and intermodal in its scope, analysis, and recommendations. The scope includes evaluation and analysis of:

- Freight transportation infrastructure;
- Freight sector operations and demands on the transportation system;
- State, regional, national, and international freight trends and influences;
- Freight system strengths, opportunities and challenges; and
- Policy and investment consideration for state and local government and private industry.

The Freight Plan is primarily intended as a statewide initiative but given the nature of goods movement and transportation policy, the analysis extends beyond the Commonwealth's borders to incorporate broader regional and national considerations and trends. Additionally the Freight Plan examines how freight transportation improvements require partnership with local, regional and private sector stakeholders throughout Massachusetts.

This planning effort also included the development of a comprehensive, stand-alone Rail Plan. The Rail Plan incorporates the rail-related evaluation and deliverables from the multi-modal Freight Plan, along with a more detailed analysis of all rail infrastructure and operations. This rail-focused scope included evaluation and analysis of:

- The inventory of rail facilities in the Commonwealth;
- Evaluation of freight only rail lines;
- Evaluation of passenger only rail lines;
- Shared freight and passenger operations;
- Intermodal freight and passenger connection; and
- The major ongoing and future rail-related initiatives in Massachusetts.

The Rail Plan is fully compliant with the requirements set forth by the U.S. Department of Transportation in Title 49 of the Code of Federal Regulations (49 CFR Part 266.15).

1.2 ORGANIZATION OF THE FREIGHT PLAN

The Freight Plan provides a comprehensive evaluation of the freight system in Massachusetts across multiple disciplines including infrastructure conditions, freight operations and logistics, commodity trade flow analysis, economic development and land use, and detailed mode-by-mode assessments. This analysis builds towards an evaluation of issues, opportunities, and strategies to enhance the freight system. The Freight Plan includes specific performance measures and evaluation criteria related to the goals and objectives.

The Freight Plan consists of the Executive Summary and the full technical report. The full technical report is organized as follows.

Existing Conditions – This section provides a description of the Massachusetts freight system, the infrastructure conditions and constraints, and the regional, national, international context for trade and goods movement. It sets the baseline of current freight system conditions in Massachusetts for evaluation of freight trends, potential investment strategies, and policy recommendations. Specific elements of the existing conditions are:

- Regional, national and international context – This section describes global trade and logistics trends as well as key regional freight flows and connections as goods movement tends to involve long-distance, multi-state shipments.
- Massachusetts freight system infrastructure and operations by mode – Detailed infrastructure and operational assessments for each mode, highway, rail, seaports, and air, are provided in this section.

Future Conditions – This section is focused on economic and trade trends, issues, and opportunities. The trade and economic analysis examines recent trends in terms of freight's role in the Commonwealth's economy, land use development trends and issues, and key freight flow data by mode, commodity and shipping pattern. Specific elements of the future conditions are: economic, industry and land use development trends, which include measures on economic and demographic growth, freight transportation contributions to the Massachusetts economy, and industrial land use and freight facility data.

- Freight flows, modal choices, and shipping patterns – This section offers freight and trade shipping patterns by mode, commodity, origin-destination shipping patterns, comparing Massachusetts and US trends. It also includes forecasts of freight growth.
- Recent, on-going and planned freight initiatives in Massachusetts – The Commonwealth has a number of recent, current, and planned transportation initiatives that will benefit goods movement and this section highlights some of the key projects.
- Issues and opportunities – This section describes the key freight issues and opportunities for each mode and sets the stage for the investment scenario analysis that follows.

Investment Scenario Analysis – To address the freight issues and opportunities identified above, MassDOT developed a number of potential multi-modal freight investment strategies. Each investment strategy consists of multiple projects and supporting policies. This section presents those investment scenarios in detail, including a discussion of the evaluation criteria and benefit-cost analysis framework and results developed to assess potential freight investments. Specific elements of the investment scenario analysis are:

- Development of investment scenarios and goals – This section presents the process to identify potential freight improvements based on data analysis and stakeholder input, and explains the ultimate goals of freight investments in the Commonwealth.
- Evaluation criteria and benefit-cost analysis framework –The Freight Plan developed a freight-specific set of evaluation criteria as well as customized benefit-cost analysis tools to assess the public and private benefits of freight investments.
- Investment scenario results – Specific outcome metrics for each scenario are provided and include benefit-cost ratios, net present value (NPV), and identification of the freight projects likely to produce the greatest return on investment within each scenario.

Findings and Recommendations – The final section of the executive summary covers key freight analysis findings and a series of policy and investment recommendations to guide the Commonwealth's freight-related initiatives in the near- and long-term. Specific elements of the findings and recommendations are:

- Freight investments with the highest return on investment (ROI) – Based on the investment scenario analysis, this section focuses on the freight investments expected to produce the strongest ROI for Massachusetts, highlighting opportunities for potential Commonwealth participation in funding freight projects.
- Policy issues and recommendations – The concluding section of the Freight Plan includes specific policy issues and recommendations in terms of land use development, freight funding, and the planning and regulatory environment.

The remainder of this chapter covers the overall approach to the Freight Plan including public and stakeholder involvement process.

1.3 DATA COLLECTION AND ANALYSIS

To develop this multi-modal freight plan, a wide range of data sources and analytical tools were gathered, examined, and integrated. The most significant data resources for the Freight Plan are summarized below. Other specific data or other information resources are identified in relevant sections of the Freight Plan.

- **Economic Conditions and Trends –** This analysis incorporates data from a number of readily available data sources such as the Massachusetts Executive Office of Labor and Workforce Development, the U.S. Census Bureau, the Bureau of Labor Statistics, the Bureau of Economic Analysis, and the IMPLAN economic model for Massachusetts.
- **Trade Flow Analysis –** The major data sources to examine the movement of goods by tonnage and value were: a) 2007 Global Insight TRANSEARCH data for county-level goods movement by mode, weight, and commodity; b) Federal Highway Administration's Freight Analysis Framework (FAF) data; c) WISER import and export trade data; and d) port-specific data and forecasts obtained from Massport and other ports.
- **Modal Assessments –** MassDOT provided critical information on infrastructure, operations, traffic volumes, truck routes, and other factors. Information was also gathered directly from railroads, ports, and trucking and distribution organizations through a series of interviews and outreach.
- **Land Use Development –** The Massachusetts Alliance for Economic Development (MassEcon) provided data on available sites and buildings throughout the Commonwealth, including rail-served sites using their SiteFinder database.
- **Performance Measures and Evaluation Criteria –** The Freight Plan incorporated best practices from a number of existing freight planning studies to determine a set of metrics

that are readily available for use to track performance over time, and help evaluate and prioritize investments.

- **Funding and Financing –** Data on funding and financing were gathered directly from MassDOT, along with Massport and the Massachusetts Bay Transportation Authority (MBTA). In addition, the Freight Plan used information from published FHWA and US DOT financing studies and programs to document best practices from other states and available funding mechanisms.
- **Economic Benefit and Cost Analysis –** The Freight Plan assessed the full-range of economic impacts, benefits, and costs of proposed improvement strategies using a customized Massachusetts version of the Transportation Economic Development Impact System (TREDIS) provided by the Economic Development Research Group.

1.4 PUBLIC AND STAKEHOLDER PARTICIPATION PROCESS

A public and stakeholder participation process was woven into the development of the Freight Plan with two primary goals: (1) to inform the public and key regional freight stakeholders about the purpose and content of the state freight plans; and (2) to receive input from the public and key regional freight stakeholders about issues and needs. The importance of the input provided by the full-range of freight stakeholders cannot be overstated in terms of identifying issues, and assessing potential investment and policy strategies.

To implement the public and stakeholder participation process, a concerted effort was made to engage representatives from the thirteen Regional Planning Agencies (RPAs) in Massachusetts. Regional planners actively assisted in the Freight Plan's development by co-hosting regional public meetings, identifying stakeholders, disseminating news and notices of the study through regional contacts, mailing lists and newsletters and providing feedback on freight issues within their regions.

To gain an early understanding of the freight trends and issues and opportunities, the outreach in the initial phases of the Freight Plan was targeted to freight stakeholders and planners. Dozens of stakeholders were interviewed for information related to specific stakeholder trends, issues, and opportunities. Feedback was requested on potential strategies to improve the freight system within the Commonwealth. Given the limitations of published data, these interviews served to supplement the data analysis findings to better understand issues such as: a) true origin to destination shipping patterns and modal needs; b) realistic opportunities to divert freight from truck to other modes; and c) business and land use opportunities given current and potential policy programs and incentives. A more detailed summary of the findings from these interviews and focus group meetings can be found in the trade flow analysis chapter.

Specific efforts were made to meet with key agencies, organizations and freight service providers and associations, including Massport and the Massachusetts Seaport Advisory Council, Massachusetts Motor Transport Association, MBTA, the Executive Office of Housing and Economic Development, MassEcon, MassDevelopment, and the Massachusetts Railroad Association and its members.

A project website, www.mass.gov/massdot/freightandrailplan/, was created to provide information on the development of the Freight Plan. Accessible information included study documents and reports, notice of meetings, and summaries of public meetings. The website also had a public comment section where people could voice opinions, read comments submitted by others, and make direct contact with the Freight Plan team.

At the initiation of the study, a **Working Group** consisting of the primary freight sector stakeholders in Massachusetts was formed. Meetings of this group provided a forum for detailed involvement and feedback. All major findings and products have been developed under the guidance of the Working Group.

A series of **Focus Group** meetings were held at various stages of the Freight Plan's development to gather information and provide feedback on strategies. Participation in these meetings ranged from six to 40 attendees. Meetings were held with the following groups: Port Professionals Alliance (maritime), Boston Port Carriers (truck), and the Massachusetts Motor Transport Association. Additionally, a discussion on land use development in relation to freight infrastructure was held with regional planners, economic development officials, and key rail, marine, and aviation stakeholders. Focus group meeting presentations are posted on the Freight Plan web site.

Two rounds of **Public Meetings** were held within four regions – west, central, northeast, and southeast sections – across the Commonwealth. The initial meeting was held in the fall of 2008 at the conclusion of the data gathering phase of work. Press releases were written and distributed to dozens of newspapers announcing the public meetings. The second round of meetings was held in March 2010, again with meetings in each of the four regions of Massachusetts. The second round of meetings focused on the Freight Plan draft findings and recommendations with emphasis on investment and policy strategies. About 160 individuals attended each round of these meetings. Public meeting presentations and meeting notes are posted on the Freight Plan web site. Input from these meetings was incorporated into the final Freight Plan.

1.5 GOALS AND OBJECTIVES

1.5.1 STUDY BACKGROUND

While Massachusetts has developed a number of regional and Commonwealth level transportation studies, this is the first effort to provide a comprehensive multi-modal freight evaluation. Consequently, an important element of the Freight Plan was to develop a unifying vision, and a set of goals and objectives that can be linked to performance measures and evaluation criteria. These metrics will be used to help: a) assess the overall performance and improvement of the freight system; and b) help the Commonwealth to consistently assess and prioritize investment and policy strategies.

1.5.2 FREIGHT PLAN VISION

The Commonwealth of Massachusetts is one of the most economically competitive states in the nation. It has the third highest per capita income in the US[1] and has ranked number one in the New Economy Index by the Kauffman Institute since 1999.[2] This position of strength is owed to a number of key assets: the knowledge based economy, which currently is witnessing industrial expansion in the areas of biotech, defense, and medicine; the continued viability of traditional industries such as cranberry farming and paper production; and the powerful and relatively affluent consumer base made up of the citizens of the Commonwealth.

The vision for the future freight system in Massachusetts is to maintain and improve upon the ability to efficiently, extensively, and safely transport goods within and across its borders by

[1] http://www.census.gov/compendia/statab/2010/ranks/rank29.html
[2] http://www.kauffman.org/uploadedfiles/2008_state_new_economy_index_120908.pdf

truck, train, ship, or plane. The Freight Plan sets forth policies and prioritizes investments to facilitate the realization of the vision for the freight system. The realization of the vision for the freight system is intended to provide public benefits in the form of the efficient movement of goods and people that preserves and expands the economic viability of the Commonwealth and enhances the well-being of its citizens.

1.5.3 GOALS AND OBJECTIVES

The goals for the Massachusetts freight system were developed in the context of other MassDOT initiatives and its overall strategic plan.

The MassDOT strategic plan includes a mission statement, "To deliver excellent customer service to the people who travel in the Commonwealth and to provide our nation's safest and most reliable transportation system in a way that strengthens our economy and quality of life." To accomplish this, MassDOT has established goals as follows.[3]

- **Safety –** Manage the nation's safest transportation system
- **State of Good Repair –** Build a quality transportation system and maintain it in a state of good repair
- **Stewardship –** Operate the transportation system in a manner that embraces our stewardship of the Commonwealth's natural, cultural, and historic resources
- **Customer Service –** Deliver superb service that both anticipates and responds to customer needs
- **Efficiency –** Invest public funds and other resources wisely while fostering economic development wherever and whenever possible

Consideration for the elements of the MassDOT strategic plan was incorporated in the development of the Freight Plan.

Another key guiding principle for the Freight Plan was the GreenDOT Policy Directive. It is a comprehensive sustainability initiative with a vision that MassDOT will be a national leader in promoting sustainability through the full range of its activities, including strategic planning, construction, and system operations. The three GreenDOT goals are to: 1) reduce greenhouse gas (GHG) emissions; 2) promote the healthy transportation modes of walking, bicycling, and public transit; and 3) support smart growth development. Freight operations are an important consideration in promoting a sustainable transportation system.

In the context of these MassDOT policies, overarching goals were identified for the Massachusetts freight system as presented below.

- **Infrastructure –** Promote the preservation and improvement of the freight system infrastructure in all modes
- **Operations –** Facilitate appropriate freight system capacity and redundancy, enhance operational efficiency, and achieve a balanced mix of capacity and connections across all modes
- **Economic Development –** Facilitate freight transportation system improvements, policies and investment strategies that will enhance economic development opportunities and manage consumer costs

[3] MassDOT Strategic Plan, May 14, 2010.

- **Environment and Quality of Life –** Ensure that the freight system preserves the environment and contributes to the quality of life in Massachusetts

To fulfill these goals, the Freight Plan is focused on providing transportation infrastructure and services in Massachusetts that: 1) facilitate the movement of goods to consumers efficiently and cost-effectively; 2) support economic prosperity for Massachusetts businesses; and 3) promote a strong quality of life for Massachusetts residents. The recommended investments and policies of the Freight Plan were developed in this context and the analysis of benefits and costs of freight improvements explicitly measured: a) the transportation costs, travel time, safety, and efficiency of goods movement; b) the environmental benefits of shipping more freight by rail and water; and c) the economic impacts of potential investments.

Specific policy and performance objectives tied to the goals of infrastructure, operations, economic development, and environment and quality of life are presented below.

Infrastructure and Operations – *Ensure adequate capacity and operational efficiency of the freight system in Massachusetts.*

Objectives

- Ensure adequate multi-modal and intermodal freight capacity throughout Massachusetts
- Provide infrastructure redundancy and competitive freight corridors and routes to meet domestic and global demand
- Reduce delays and bottlenecks across the multi-modal freight system by optimizing the operations of existing facilities and pursuing strategic capacity enhancements
- Ensure effective freight and passenger rail usage of shared rail infrastructure and operations
- Provide infrastructure improvements to maintain and expand competitive freight flows to and from the Commonwealth
- Reduce the number of freight related accidents in the Commonwealth
- Provide redundancy and flexibility within the system to meet unanticipated events and aid emergency response

Economic Development – *Support development and a healthy economy through informed investment in the freight and passenger rail system.*

Objectives

- Provide an efficient, competitive, and low cost shipping network for Massachusetts which will benefit businesses across all key industries, as well as consumers
- Enhance the integration of land use, economic development, and freight transportation, including maintaining and preserving strategic sites and areas within the Commonwealth for freight-related activities
- Encourage freight transportation investments with positive economic benefits to the Massachusetts economy
- Mitigate and minimize land use conflicts with freight transportation, and encourage freight- and rail-oriented development opportunities
- Preserve and enhance freight-related economic activity (jobs, wages) in strategic locations throughout Massachusetts

Environment and Quality of Life – *Ensure that improvements to the freight system do not negatively impact the environment and help improve the quality of life for Massachusetts residents.*

Objectives

- Enhance and promote the linkage between an efficient freight system and sustainable development in the Commonwealth
- Enhance and promote the linkage between an efficient passenger rail system and sustainable development in the Commonwealth
- Encourage freight modes, strategies, and investments that promote environmental benefits and minimize negative effects
- Identify and implement freight-related technologies and policies that improve or protect the natural environment

These objectives are reflected in the development of investment scenarios, the quantitative evaluation of scenarios, and the Freight Plan findings and recommendations for both infrastructure and policy.

2 Existing Conditions of Massachusetts Freight System

This section of the Freight Plan presents a summary of other recent freight studies, an overview of the current state of the freight industry at a global, national and regional level, and an overview of the existing conditions on each of the freight modes – highway, rail, maritime, and air. Within each modal section is an analysis of the existing system condition, ownership, usage, issues, and opportunities.

2.1 SUMMARY OF KEY RECENT FREIGHT STUDIES

The Freight Plan is intended to build upon other efforts to examine the freight and rail systems in Massachusetts and the northeast region. As part of the development of the Freight Plan, a number of different local, regional, and national focused studies were reviewed to better understand existing issues as well as best practices from other areas. The following summaries of three particularly relevant freight and rail studies to Massachusetts are presented as representative of information extracted from reports reviewed by the Freight Plan team. Other key national freight studies and reports referenced in this Freight Plan include:

- *Financing Freight Improvements*, US Department of Transportation, Federal Highway Administration (FHWA), January 2007.
- *National Rail Freight Infrastructure Capacity and Investment Study,* for the American Association of Railroads by Cambridge Systematics, Inc., September 2007.
- *Cost Benefit Analysis,* FHWA, Office of Freight Management and Operations, multi-year study: http://ops.fhwa.dot.gov/freight/freight_analysis/cba/index.htm.

2.1.1 ―IDENTIFICATION OF MASSACHUSETTS FREIGHT ISSUES AND PRIORITIES" (1999)

Identification of Massachusetts Freight Issues and Priorities was prepared for the Massachusetts Freight Advisory Council (MFAC), in an effort to improve communication between private and public interests, encourage participation, and advise the agencies of Massachusetts related to freight. The study provides an extensive description of the Massachusetts freight industry structure and then presents and ranks the issues identified by the freight community in an attempt to increase the efficiency of the current freight transportation system.

MFAC REPORT KEY ISSUES

This report focused on categorizing the key issues of the Massachusetts‟ freight system by each mode and geography as identified by stakeholders, including freight shippers and carriers. The MFAC identified the truck network and airports including bottlenecks and stakeholder concerns. Port operations were discussed for nine (9) ports in Massachusetts. The issues and priorities identified can be categorized into five groups:

- Access plans and projects;
- Regulatory actions;
- Policy coordination and change;
- Informational projects; and
- Other issues.

Within these categories, specific issues were identified, ranked by importance, and grouped by region. Public outreach concerns were included in the issues identified. The issues ranked with high importance include those described below.

- **Statewide –** Administrative coordination, completion of ongoing highway projects, consistency of enforcement and regulations, double stack rail clearance, and improved communication between industry and agencies
- **Western Massachusetts –** Pittsfield-Massachusetts Turnpike connection feasibility study
- **Central Massachusetts –** Worcester Regional Airport access
- **Southeastern Massachusetts –** Air freight at New Bedford Airport, roll-on/roll-off ferry terminal in New Bedford, truck informational signs
- **Northeastern Massachusetts –** Central Artery (CA/T) Tunnel project, hazardous materials movement, Logan Airport access, real estate development in South Boston, trucking access to South Boston industrial areas

MFAC REPORT GOALS AND STRATEGIES

Areas for strategic regulatory action were identified. While most of these actions were related to the truck mode, some could be applied to freight overall. The overarching strategic regulatory action that could be applied to all forms of freight transport was a call for consistency between federal, Commonwealth, and local regulations relative to the transport of hazardous materials.

Since a large effort was made to involve stakeholders and shippers, the major finding was that participant comments reflected issues that would improve an already functioning transportation system. For the most part, comments reflect a concern for refining existing facilities and institutional arrangements, as well as a desire to ensure continued planning to meet the future demands necessary to remain competitive in the global market.

MFAC REPORT RECOMMENDATIONS

Most of the issues presented in the MFAC report suggest the refinement and improvement of existing facilities as well as improving communication and coordination statewide. The overall recommendation is to maintain an inventory for planners and to aid prioritizing infrastructure investments for the future. In addition to prioritization, the following efforts were requested:

- Work towards administrative coordination and consistency of enforcement and regulations between multiple jurisdictions (local, Commonwealth, and federal) especially in the handling of hazardous materials and truck route restrictions.
- Maintain and expand outreach through contact between the freight industry and public agencies. Maintain a single point of contact for the freight industry.
- Reduce constraints on trucking industry: issuing overweight permits, truck exclusion rules, Massachusetts Turnpike tolls, and diesel fuel taxes.

2.1.2 —MASSACHUSETTS RAIL TRENDS AND OPPORTUNITIES” (JULY 2007)

The Massachusetts Rail *Trends and Opportunities* (MRT&O) report from July 2007 was prepared for the Massachusetts Executive Office of Transportation and Public Works (EOT).[1] It presents an overview of the Massachusetts" rail network with freight related trends,

[1] The Executive Office of Transportation and Public Works was integrated into the Massachusetts Department of Transportation (MassDOT) in 2009.

challenges and opportunities, both within the Commonwealth and throughout the country. It provided guidance relative to immediate and long-term policy decisions relating to infrastructure and service.

MRT&O REPORT KEY ISSUES

The MRT&O report correlates rail growth with the level of investment in the national rail system to evaluate how well railroads will be able to absorb growth in the competitive transportation market. Future planning is necessary to ensure that operations can coexist while still meeting shipper needs. The major issues identified were the overall constraints of the existing system, and are representative of New England‟s history and density:

- Land or funding constraints leading to shared use corridors.
- Despite increasing capital expenditures, rail infrastructure still cannot accommodate demand, which could lead to diversion to other modes or congestion at bottlenecks.
- Service problems and lack of equipment that could reduce role of rail.

MRT&O REPORT STRATEGIES

The major strategies of the MRT&O report were developed into four main categories: 1) public ownership of the rail network for preserving and managing the rail system; 2) the infrastructure system constraints and bottlenecks need to be identified, addressed, improvements programmed, and progress documented; 3) manage efforts to improve coordination and communication between administration and stakeholders; and 4) preserve the existing system by allocating sufficient resources effectively.

The specific strategies included:

- Increasing track capacity to allow for passing trains on key shared use corridors
- Increasing yard capacity for intermodal transfers
- Improving grade crossing safety
- Focusing on the preservation of key corridors and Class I service
- Securing capital funding to address critical long-term needs
- Identifying resources to fund and promote projects that meet system preservation and sustainability goals
- Exploring options for public/private partnerships and other innovative financing mechanisms
- Addressing growth in traffic congestion through strategic, multimodal management
- Establishing a role for MassDOT within the dynamic that may include evaluating options for removing or mitigating any negative operations or financial impacts

MRT&O REPORT RECOMMENDATIONS

The major recommendations of the MRT&O report for MassDOT actions include the following:

Network Rationalization

- Play a meaningful role in decisions that impact operations and infrastructure, identify critical freight rail corridors, and evaluate the system as a whole. Attempt to improve rationality and functionality.

Infrastructure

- Prioritize investments according to a set of objective project evaluation criteria. These criteria may include threshold ratings for various factors such as age of asset, remaining useful life, operational impact, and cost effectiveness.
- Consider expansion and improvement in the context of the Commonwealth"s freight rail funding and economic development funding programs.
- Conduct an initial assessment to establish a range of investments to preserve the existing system, enhance rail service, and improve the relative position of freight rail in the transportation network.

Grade Crossings

- Continue to work with MBTA and MassDOT Highway Division to develop a coordinated, programmatic approach for identifying and resolving safety concerns. Supplement this with private input and include operational, financial, and liability considerations that impact private railroads and public entities responsible for the highway/road crossings.

Vertical Clearance & Capacity

- Create an internal reporting mechanism to evaluate the current status of issues on vertical clearance, chokepoints, and decision making.
- MassDOT may want to consider working with private operators and neighboring states to designate critical high density corridors for weight capacity improvements.

2.1.3 ―NORTHEAST RAIL OPERATIONS STUDY" (JULY 2007)

The Northeast Rail Operations Study (NEROPS) was commissioned by the I-95 Corridor Coalition, which is a partnership of state departments of transportation, regional and local transportation agencies from Maine to Florida, including some members in Canada. The "Northeast Rail Operations Study" addresses many characteristics of the regional transportation network describing the regional stakeholders and operations, trends influencing growth and operations, the constraints (bottlenecks) of the system, and it provides recommendations to the northeastern states to address freight and passenger rail.

NEROPS REPORT KEY ISSUES

Several intercity passenger and commuter railroads operate in the northeast, often by different entities. The major issues and obstacles to passenger and commuter rail include the growing demand for service, evolving markets and logistic patterns, continued financial challenges of the railroad industry, and regional growth constraints. For much of the northeast, operations have combined passenger and freight on the same corridors, which can often create operational and institutional constraints. Many smaller railroads cannot accommodate 286,000-pound railcars, and therefore cannot handle larger trains. Additionally, demand for freight is on a long-term upward trend with rising global trade volumes. Where feasible, direct port-rail connections are more desirable to help lower costs and ship goods seamlessly from ports to inland markets.

The following are key characteristics of the northeastern rail system:

- Presence of several intercity corridors serving both passenger and freight movements
- Integrated cross-border operations
- Mature transportation infrastructure, access limitations, and challenges to add capacity
- Large and diverse set of regional stakeholders

- Institutional challenges that impact the ability of states, MPOs, railroads, and stakeholders to improve system performance

Limited funding for capital investments is becoming a problem as rail carriers perform and plan key investments. However, demand for passenger and freight service is outpacing improvements. Regional providers receive less outside investment than the larger railroads. Additionally, growth and distribution patterns are straining the performance of all modes due to congestion.

The infrastructure and operations are limited by the northeastern United States" aging rail inventory and low bridge clearances along certain routes. These cannot support increasing passenger and freight traffic, while existing yards and terminals are unable to meet expanding demand. Many of these issues are exacerbated by multiple jurisdictions and state borders. These issues make programming and implementation of rail projects difficult to incorporate into the traditional transportation and programming processes, which has severe funding limitations to begin with.

NEROPS REPORT GOALS AND STRATEGIES

The NEROPS report"s major goals and strategies involved cooperative efforts at maintaining the current infrastructure and effectively addressing the issues with informed decision making. The cooperative efforts should include working as a region to:

- Develop a better understanding of planned rail improvements
- Identify gaps where further investment would improve regional operations
- List and prioritize regional rail improvements based on estimated costs and potential benefits of the program
- Identify potential institutional mechanisms that could be used to finance and implement a regional rail improvement program
- Develop and apply methods to better quantify public benefits of rail investments

For Amtrak and the Northeast Corridor (NEC), the key proposals should be:

- Separate Amtrak infrastructure and operating responsibilities to different companies
- Rail operations transferred to a multi-state NEC compact
- Avoidance of Amtrak service loss: dispatching, track access, and financial maintenance of rail facilities

NEROPS REPORT RECOMMENDATIONS

The major recommendations of the NEROPS report are centered on communication, partnerships, and overall rail awareness. First, the legislators and other transportation decision-makers must be educated on the importance of passenger and freight rail to the region. Stakeholders and authorities should actively participate in regional and national rail planning and policy efforts, and better integrating freight and freight rail issues throughout the transportation planning and programming process is an important goal. Additional participation should be made in developing and refining approaches to address Amtrak issues in the region.

2.2 GLOBAL, NATIONAL AND REGIONAL FREIGHT CONTEXT

Freight and the movement of goods is a dynamic industry with a broad range of influences. A significant influence, with implications for Massachusetts and the region, is the global production patterns and shifting economic activities related to national and international trade.

Additionally, technological advances in transportation infrastructure, consolidation of carriers in all modes, and equipment improvements used to move freight impact freight transportation. Changes in trade and freight logistics trends have shaped the magnitude of freight demand and the relative use of specific modes. These issues are expected to continue to influence freight transportation in the future.

Freight volumes are a direct reflection of the underlying demand for goods and services and the spatial relationship between the origins of various products and where they are destined. While mode-specific industry issues and opportunities are presented in the next Chapter of the plan, the analysis that follows presents some broad trends in trade and shipping from a global, national, and regional perspective.

The current national economic conditions, influenced by recent events, such as fluctuations in fuel prices, sub-prime lending, an overall contraction of economic activity, and the American Recovery and Reinvestment Act of 2009 (ARRA), are currently impacting near-term freight flows and may delay or even slow longer-term growth. Another major obstacle will be national infrastructure, congestion, and overall system capacity, which could impede overall national freight flows. This document outlines several of the more prominent issues and trends in shipping that directly influence the freight industry and trade volumes in Massachusetts today and into the future.

2.2.1 GLOBALIZATION

Globalization and the increasing inter-dependence of the world"s economies have had an instrumental effect on the magnitude and distribution of global freight activities. In the 1960s, international trade accounted for less than 10 percent of total US Gross Domestic Product (GDP). By 2006, it accounted for 28 percent.[2] This increase in trade is forecast to continue, with trade growing at a faster rate than the economy as a whole.

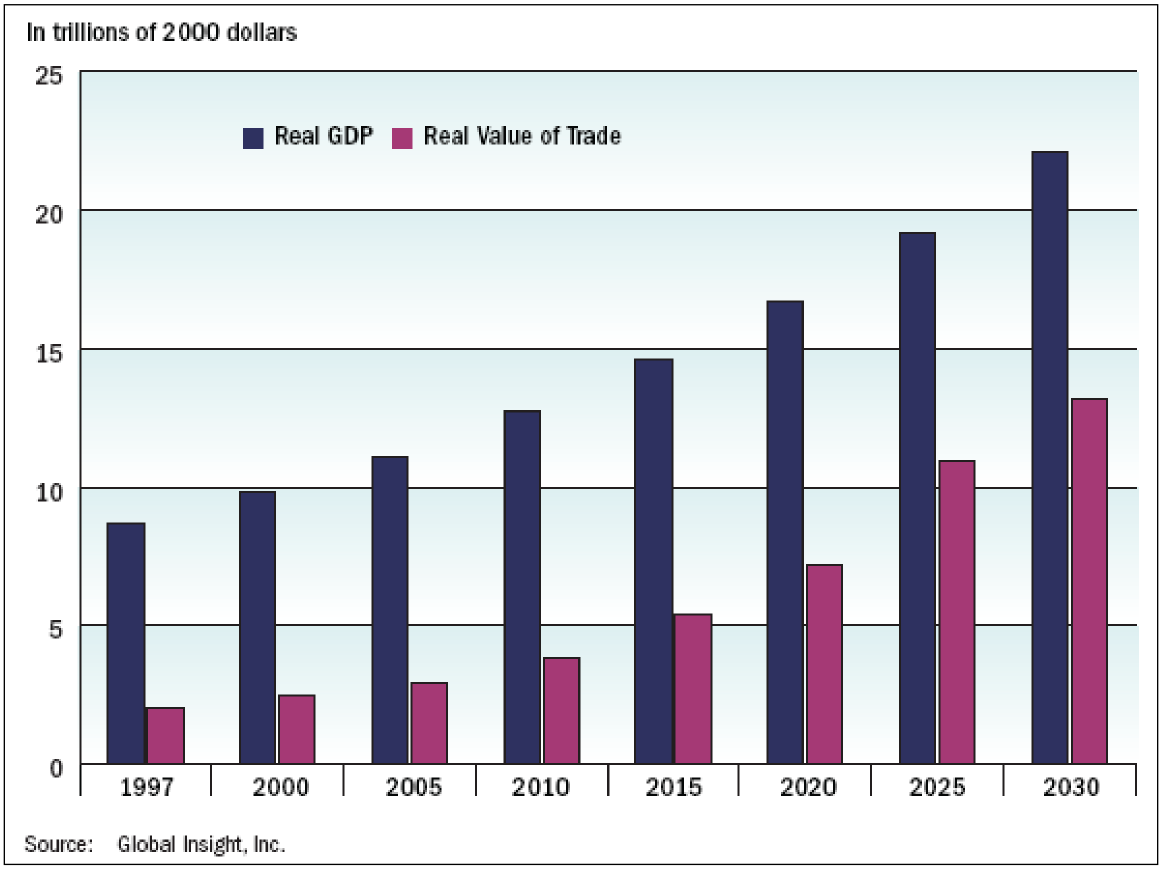
The forecasted increase of international trade relative to the US economy is shown in Figure 1, with trade accounting for more than 50 percent of GDP by 2025.[3]

Because of globalization, markets have developed from local and regional to national and global. As noted by the US Chamber of Commerce, US companies have developed a "growing reliance on other countries for raw materials, lower-value manufactured goods, and some services." Consequently, efficient access to and from international gateways will continue to be a key element of economic competitiveness.

Domestically, the US population is projected to increase from 300 million to 380 million in the next 30 years. The US economy is expected to more than double in real terms, with per capita household income increasing from $37,000 to $66,000.[4] These trends are indicative of the expected growth in consumer demand for trade and goods movement.

[2] US Bureau of Economic Analysis, national income and product accounts (NIPAs).
[3] Ibid.
[4] "The Transportation Challenge: Moving the US Economy," prepared in 2008 by Cambridge Systematics, Inc. for the US Chamber of Commerce.

Figure 1: The Value of US Global Trade Relative to GDP



2.2.2 EMERGENCE OF CONTAINERIZED SHIPPING

The emergence of containerized shipping has revolutionized the international shipping industry by making it possible to ship goods in standard-sized boxes called containers, which are often shipped by international ocean carriers that only carry containers destined for inland markets.

The dramatic increase in containerization has brought ease and speed to vessel loading and unloading, dramatically increasing shipping efficiency. With growth in global trade volumes, the size of container ships has grown. Ever-larger ships create economies of scale, reducing per unit shipping costs. As a result, container-based shipping has become the fastest growing shipping sector, dominating seaborne trade.

The emergence of container-based shipping led to a similar technological change in the rail industry. Double-stack shipments, where two containers are stacked atop each other, replaced truck trailers moving on rail. This resulted in more containers per rail car, as well as reduced weight because double-stacking eliminates the heavy undercarriages and wheels of trailers. This weight reduction significantly reduced fuel costs and thereby shipping costs per ton. In combination with ocean container shipping, it also reduced transport times. Most significant of all, container-based shipping introduced dramatic change in how the international container industry was marketed and organized with benefits also accruing to the domestic transportation market. The industry became an integrated water- and land-based transportation system, a system of seamless intermodalism, one promising efficient container movement from ship to rail and truck.

Lower international shipping costs meant that global-level manufacturing and distribution became easier. For example, automobiles could be made with raw materials and parts produced around the world, and they could be assembled in locations distant from where parts were produced but distributed broadly.

In the context of economic globalization, consolidation took place across the transportation industry and led to the concentration of container traffic at fewer ports. Among shipping lines, the trend of consolidation by merger, acquisition, and alliances, has created *global* carriers. Shipping lines became fewer in number and larger in size; they used larger vessels, made fewer calls on main line haul routes, and employed more feeder services. Similarly, there was consolidation in the rail industry, resulting in bigger but fewer railroad companies, and domination in the US by the Class I railroads.

At the same time, logistics trends of door-to-door just-in-time service – made possible by the globalization of the world economy and trade – demanded new performance standards of shipping lines. Consolidation strengthened their leverage in pressing these demands on the entire transportation industry. Shipping lines, ports, and landside transport had an interdependent stake in performance. Ports with deep berths, close access to markets, and double-stack train access became the preferred ports of call for major shipping lines.

2.2.3 THE ‗CHINA EFFECT' AND IMPORTS FROM ASIA

As globalization and containerization increased dramatically over the past 30 years, China‟s economy has grown significantly, led by strong international exports. In fact, China‟s share of global GDP tripled in 30 years. More recently, imports from China to the US have more than quadrupled from 1998 to 2007 (Table 1). In five of the ten years between 1998 and 2007, US imports from China grew more than 20 percent annually; for another three, they grew more than 10 percent per year.

Table 1: US-Chinese Trade with the US ($Billions), 1998-2007[5]

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
US Imports	71.2	81.8	100.0	102.3	125.2	152.4	196.7	243.5	287.8	321.5
% change	13.8	14.9	22.3	2.2	22.4	21.7	29.1	23.8	18.2	11.7

Sources: US International Trade Commission, US Department of Commerce, and US Census Bureau

The "China Effect" significantly impacted trade routes, with transpacific trade becoming dominant in the US. The Port of Los Angeles and Long Beach (POLALB) became the main US gateway with the largest volumes of containers. Those ports leveraged deep berths, as well as double stack train access to the US interior, for market share. Containers moving from the POLALB via double-stack trains (i.e., the landbridge) became the fastest route for Asian traffic to the eastern coast of the United States. Other West Coast ports grew in the US and Canada as well, as Asian economies and transpacific trade expanded. This led to more containers traveling to the east coast via the landbridge. However, growth on inland routes often travels through the Chicago area, which can be a bottleneck and is the focus of major rail initiatives to alleviate congestion on the rail network.

[5] US International Trade Commission, US Department of Commerce, and US Census Bureau.

Container traffic statistics for the US show both the concentration of activity at a few ports and the dominance of West Coast ports (Table 2). Containers handled at POLALB totaled over 15 million in 2007, by far the largest total of any US port. Of all container volumes at US ports, 79 percent moved through the top ten ports with West Coast ports, such as POLALB, Oakland, Seattle, and Tacoma, dominating.

Table 2: 2007 Container Traffic Volumes (TEUs)* at Top Ten US Ports

2007 Rank	Port (State/Province)	Country	2007 TEUs
1	Los Angeles (CA)	United States	8,355,039
2	Long Beach (CA)	United States	7,316,465
3	New York/New Jersey	United States	5,299,105
4	Savannah (GA)	United States	2,604,312
5	Oakland (CA)	United States	2,388,182
6	Vancouver (BC)	Canada	2,307,289
7	Hampton Roads (VA)	United States	2,128,366
8	Seattle (WA)	United States	1,973,504
9	Tacoma (WA)	United States	1,924,934
10	Houston (TX)	United States	1,768,627
11	Charleston (SC)	United States	1,754,376

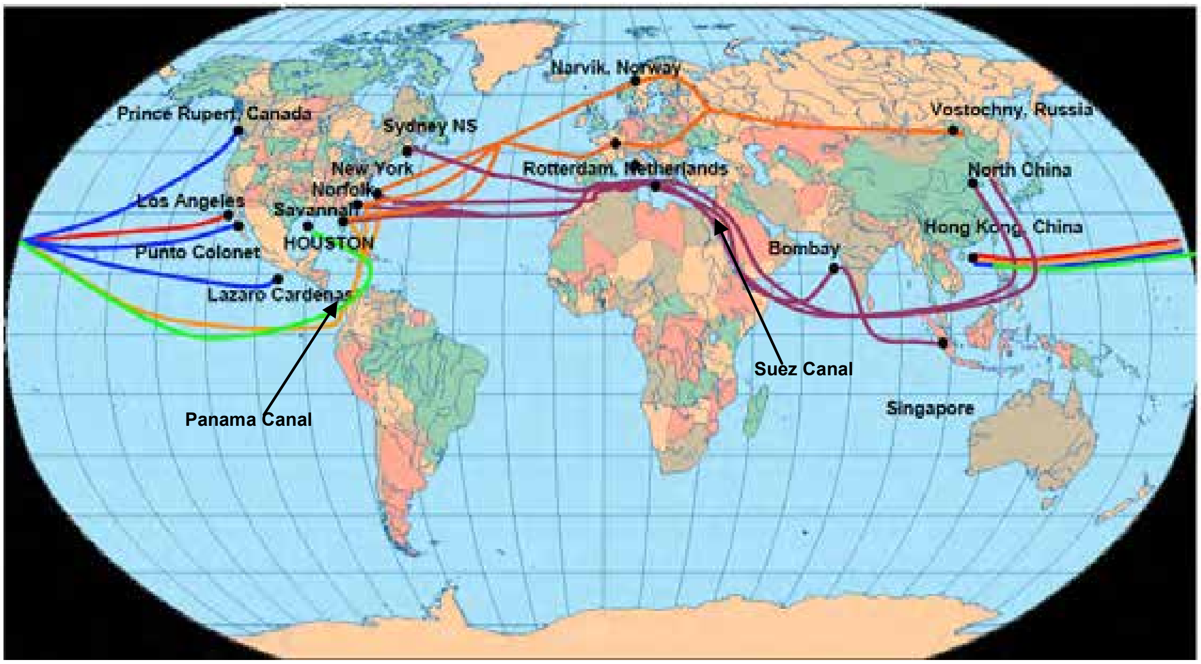
* TEU= Twenty-foot Equivalent Units, the standard container measure
Source: American Association of Port Authorities (AAPA)

The pace of the growth in trade, along with technological changes and mega-size shipping vessels, imposed new requirements on ports and landside transport to accommodate them. These included greater navigation depths, larger berths, bigger cranes, and adequate capacity to meet the demand at ports and on trains. As a result, west coast ports, as the major gateways, were overwhelmed with congestion on their landside access roads and rail.

Due to congestion and bottlenecks at West Coast ports, and to better serve the large markets on the eastern coast of the US, new all-water routes via the Panama and Suez Canals rose in use as alternatives (see Figure 2). Primary beneficiaries of these all-water routes were the east coast ports of New York/New Jersey, Savannah, Georgia, Norfolk, Virginia,[6] and Charleston, South Carolina. Each of these ports experienced increases in TEUs in recent years, though the current economic recession has caused global trade and port volumes to decline in the near-term. These ports serve a combination of European, South American and Asian trade. The Port of New York and New Jersey is the largest East Coast port with over 5 million TEUs handled. In 2003, all-water Asian imports dominated volumes at the Port for the first time, overtaking European import volumes.

[6] Norfolk is a dedicated container terminal, the largest terminal of the Virginia Port Authority terminals, and is located in Hampton Roads; it is also referred to as Hampton Roads, Norfolk, or, Virginia Ports (which includes other terminals handling containers and/or other types of cargo).

Figure 2: Existing New Routs for US Imports



Source: Matrix, from *"Logistics Trends and Infrastructure How Much More?"* from The Importance of a Sustainable Goods Movement Industry to the Economy of New Jersey, presentation, Richard F.X. Johnson, 2/28/07

While New York has the highest volumes, the Port of Savannah has had the fastest rate of growth in all-water Asian cargo among East Coast ports. Savannah has a geographic advantage. Of the major East Coast ports, it has the shortest route and is the first inbound port of call or the last outbound one on all-water Asian routes.[7]

In addition to geographic advantages, the Port of Savannah‟s growth strategy was unique. The Port was the first to target all-water Asian traffic**.** Major US shippers such as Wal-Mart and Target, which had established distribution centers in the Savannah area in 2000, had done this only after Georgia (as well as other southern East Coast ports) had marketed easily developable, inexpensive real estate for this purpose. The port also built a new intermodal container transfer facility reducing dwell time for containers. This has led to railroad offerings of expedited overnight service to Atlanta, and short two- to four-day transport times to key inland locations such as Memphis and Chicago.[8]

What makes all-water Asian service to East Coast ports viable, and even preferred, is the transit time reliability. Transit time may be longer by an all-water route, but it is predictable, a characteristic highly prized by shippers, particularly retailers, many of whom operate on a just-in-time basis. Rail delays can add an extra seven days to landbridge transit times from the West Coast, especially in peak retail shipping season and in the Chicago area.

While China‟s economy continues to grow, other East Asian countries south of China have also grown their trade economies. The significance of South Asian trade is that the shipping distance via the Suez Canal to East Coast markets in the US is shorter than from China. As a

[7] Florida-based ports such as Jacksonville, Everglades and Miami also handle significant volumes of TEUs but tend to serve a broader mix of trading partners, especially with South America.
[8] Ibid.

result, that shipping route can compete with the Panama Canal route. For example, the difference in distance between the Port of New York and Hong Kong via the Suez Canal and the Panama Canal is small (less than 300 miles). For Asian ports south of Hong Kong the distance becomes significantly shorter by the Suez route (e.g. approximately 2,300 miles shorter for Singapore).

A new option also has arisen with the development of the new West Coast Canadian Port of Prince Rupert, which is 700 nautical miles closer to Asia than Los Angeles and Long Beach. In addition to proximity, the Port was specifically designed as a pure intermodal rail port. With on-dock rail yards allowing for direct ship-to-rail transfer, there is the opportunity for extending ship and port specialization in containers, to landside transport specialization in intermodal rail. Since Prince Rupert has connections across Canada, it can bypass Chicago and could become an “express” landbridge to the Midwest and East Coast of the United States. New ports in Nova Scotia, which are the closest North American points for all-water express Suez Canal services, have a similar opportunity for pure intermodal rail services. These ports also offer reduced transit times.

2.2.4 EMERGING ECONOMIES

In addition to China, the emerging “BRIC” economies (Brazil, Russia, India, and China) have had a significant impact on the flow of commodities and manufactured goods as their economies experience rapid economic growth. Continued strong growth is projected for these countries and they will wield a significant influence on global trade patterns, including affecting the volume of freight through individual gateways.

Seaports on both the west and east coast are competing and planning for continued growth in containers from Asia bound for markets throughout the US. It is too early to tell how factors such as the expansion of the Panama Canal, the opening of the Suez Canal, and strained capacity and delays at POLALB and Chicago will shift domestic trade patterns. It is clear, however, that the national freight system must be flexible with viable alternative routes and facilities if it is to retain competitiveness.

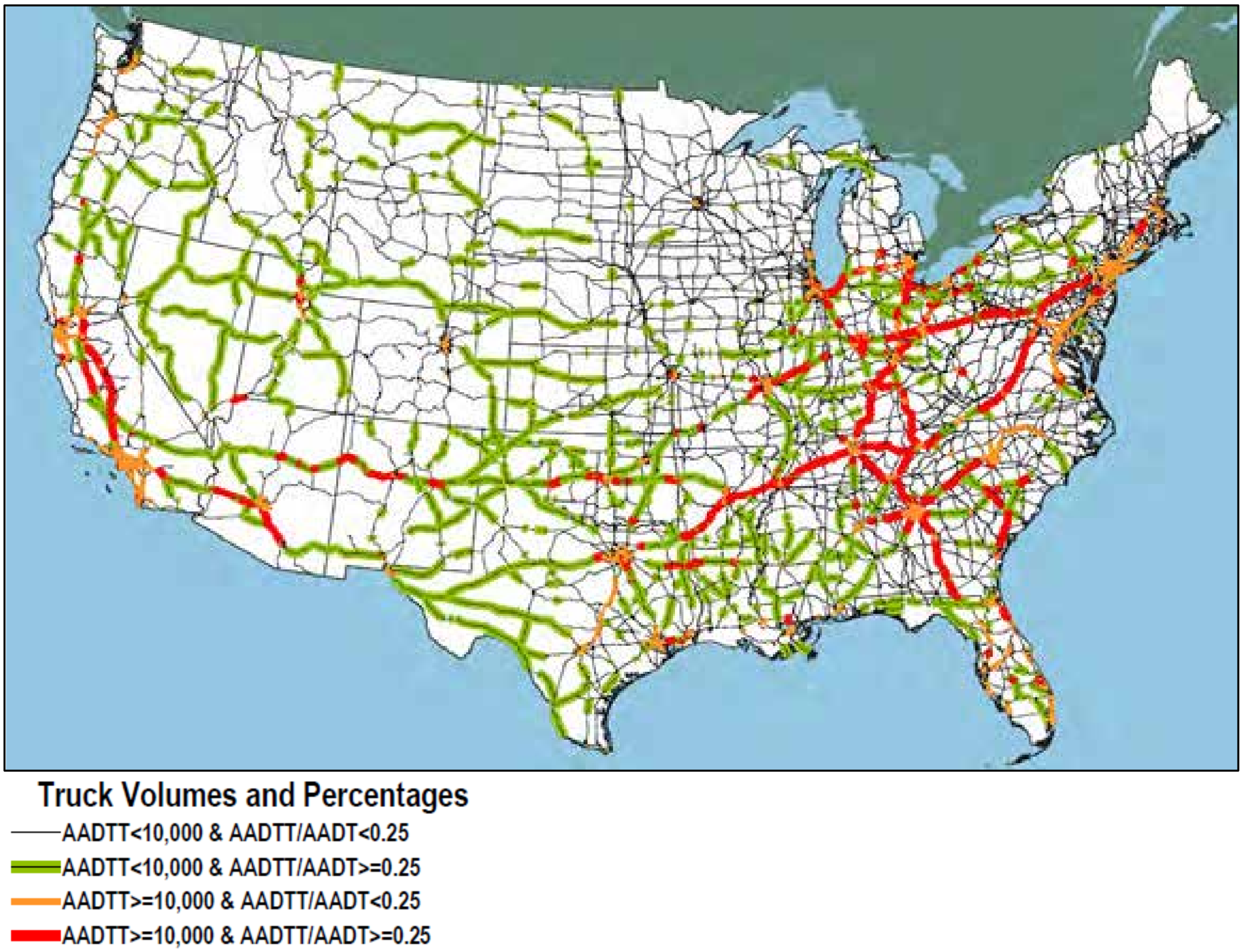
2.2.5 US FREIGHT INFRASTRUCTURE CAPACITY CONSTRAINTS

The US transportation system is at or over capacity in many areas at certain times; industry groups argue that the existing system is insufficient to handle current demand.[9] This means that the current system may be ill-equipped to handle the substantial growth in trade volumes projected over the next twenty years. As an example, Massachusetts freight volumes are projected to increase by 70 percent by 2030 (based on Global Insight projections). Because of the anticipated growth in freight volumes, the level and type of investment in infrastructure will have a tangible impact on the freight industry.

Highway congestion is an issue on our national highway system (see Figure 3) and only expected to worsen, especially as truck volumes continue to grow. This is especially true for the northeast region and the I-95 corridor area with projections for traffic volumes exceeding capacity on most major Interstate highways in Massachusetts.

[9] For example, see the National Rail Freight Infrastructure Capacity and Investment Study for the American Association of Railroads (2007) and The Transportation Challenge: Moving the US Economy for the National Chamber Foundation of the US Chamber of Commerce (2008).

Figure 3: US Truck Volumes and Highway Congestion, 2002

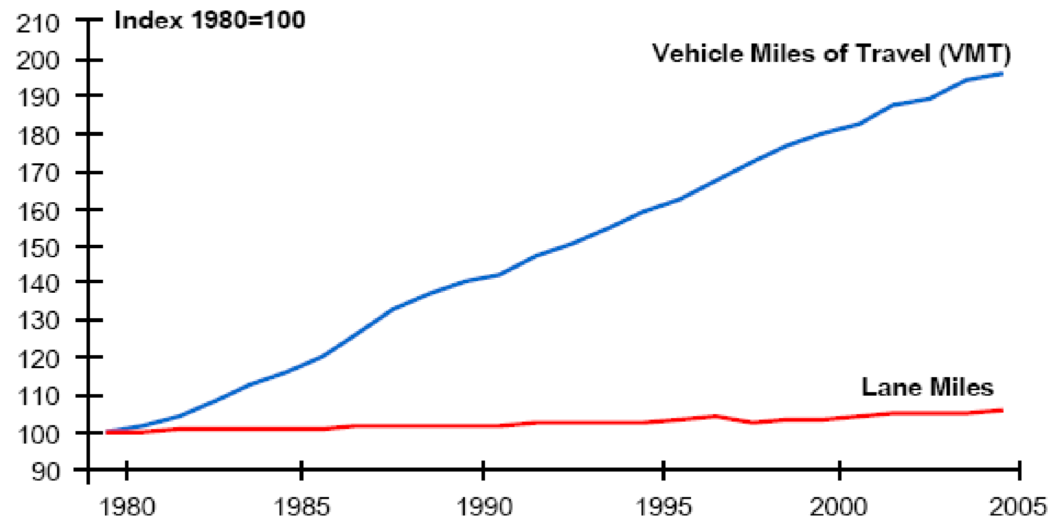


Source: Federal Highway Administration, Freight Analysis Framework

Traffic congestion has increased substantially in recent years. According to the Texas Transportation Institute‟s (TTI) “2007 Urban Mobility Report,” highway congestion increased by 25 percent from 1982 to 2010 and estimated that congestion results in over 93,000,000 person hours of delay per year, wasting some 62.5 million gallons of fuel, with a congestion cost penalty of $895 per driver in 2005.[10] TTI ranked the Boston metropolitan region as number 12 in the nation for congestion delays. The cause of congestion is clear, as illustrated in Figure 4, where the number of vehicle-miles traveled doubled from 1980-2005 and highway capacity increased only slightly.[11] Without investment in additional capacity or other operational tactics such as the implementation of congestion-related road pricing, additional growth in traffic will exacerbate existing road congestion and adversely affect the trucking industries. The result will likely be higher costs, more delays, and reduced economic competitiveness.

[10] Texas Transportation Institute, 2007 Urban Mobility Report, http://mobility.tamu.edu.
[11] This figure is found in the 2007 report titled “National Rail Freight Infrastructure Capacity and Investment Study”, produced for the Association of American Railroads.

Figure 4: Vehicle-Miles of Highway Travel and Lane-Miles, 1980-2005



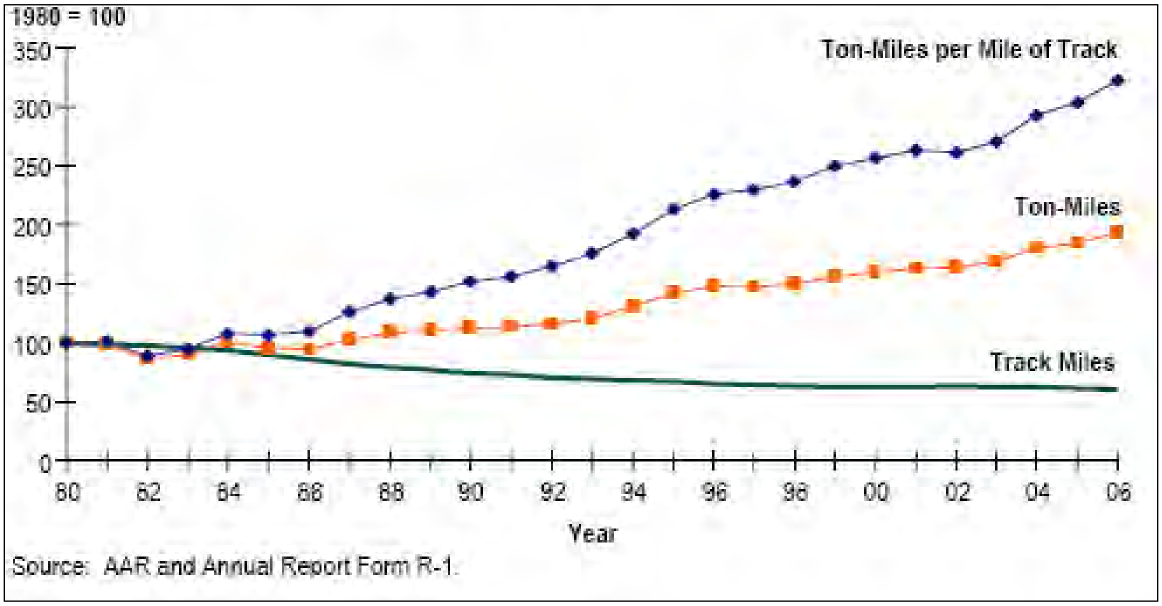
Source: Federal Highway Administration, *Highway Statistics*.

The port system and the rail network are also experiencing severe levels of congestion as growing volumes strain against existing capacity, as shown in Figure 5.[12] The utilization of existing capacity for the freight rail industry has more than tripled from 1980 to 2006.

To accommodate forecasted traffic growth, the Association of American Railroads, an industry trade group, that the highway system must add capacity to handle 98 percent more tonnage, while railroads must add capacity to facilitate 88 percent more tonnage. This equates to $148 billion in rail infrastructure investment (in 2007 dollars) over the next 28 years.[13] More recently, the National Surface Transportation Policy and Revenue Commission recommended the creation of a program of investment in a report called “Freight Transportation: A Program to Enhance US Global Competitiveness.” In that report, the commission recommended a substantial national commitment to transportation investment of “at least $225 billion annually from all sources for the next 50 years.” While projections of future freight investment needs can be inflated and need to be tempered by the source providing the estimates, it is generally acknowledged that long-term transportation funding needs exceed currently projected sources of revenue.

[12] This figure is also found in the “National Rail Freight Infrastructure Capacity and Investment Study.”
[13] “National Rail Freight Infrastructure Capacity and Investment Study” for the American Association of Railroads (2007).

Figure 5: Rail Freight Ton-Miles and Track Miles - Class 1 Railroads, 1980-2006



A recent assessment of the US transportation network‟s infrastructure by the American Society of Civil Engineers accentuated the critical need for large-scale investment across all modes. To address the infrastructure implications of these major trends, the US Congress created the National Surface Transportation Policy and Revenue Study Commission in 2005 to evaluate existing transportation conditions and funding availability. The Commission recommended the creation of a program of investment entitled "Freight Transportation: A Program to Enhance US Global Competitiveness." The Commission report recommended a substantial national commitment to transportation investment of "at least $225 billion annually from all sources needed to maintain a state of good repair on the nation‟s multi-modal transportation system."[14]

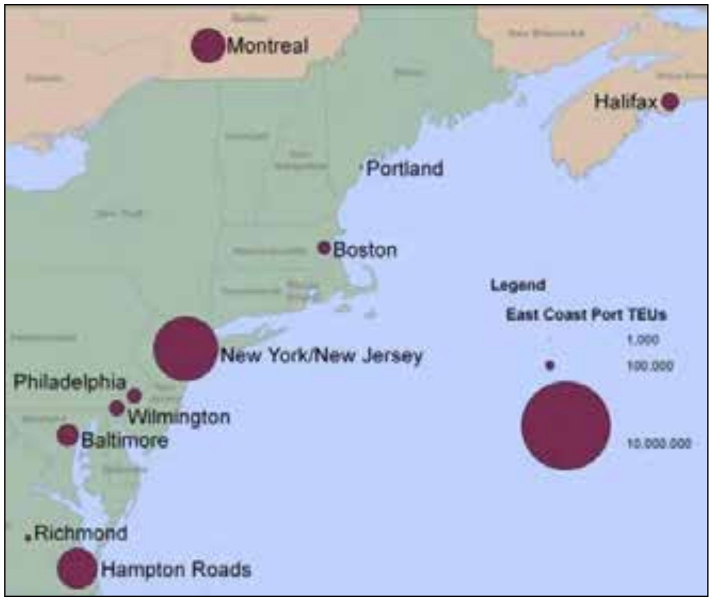
2.2.6 REGIONAL PORTS AND FREIGHT FLOWS

In addition to some of the major ports described above, there are also ports with more regional services, serving a mix of international shipping routes as well as domestic barges and generally lower volumes. For example, the Port of Boston (POB) is generally considered a regional port, with approximately 75 to 90 percent of all inbound goods destined for locations within 100 miles of Boston according to Massport.

The Port of New York and New Jersey (PONYNJ) dominates the northeast for containers handled (Figure 6). Massport estimates that the Port of Boston serves about 30 percent of the region‟s waterborne freight, helping to explain the large amount of freight flows from New York to Massachusetts with heavy truck volumes on I-84, I-90 and throughout the Boston metro area. With some recent growth in TEUs handled, the POB attracts containers primarily destined for its New England market. Some of these come by direct calls from steamship lines and some by feeder services, primarily via the PONYNJ. The PONYNJ calls are in decline; feeder services formerly via the Port of Halifax are no longer in operation.

[14] See http://www.transportationfortomorrow.org/

Figure 6: Containers (TEUs) Handled by Northeast Ports, 2008



Source: American Association of Port Authorities

Shifting trade routes and shipping line network configurations – determined by cargo volumes, transit time, cost, and reliability considerations – will be large factors in determining the POB‟s future container volumes and values. A port‟s strategic decisions regarding logistics accessibility are critical factors for regional ports. For example, channel dredging to accommodate larger vessels, terminal productivity and capacity, and landside transport (e.g., to warehouse distribution facilities) are all important considerations for ports like Boston.

The largest regional inbound and outbound freight flows by tonnage for Massachusetts in 2008 are presented in Figure 7. Highlights related to these major flows include:

Freight Flow Directionality

Eight out of ten of the largest flows are inbound and only two are outbound.

Freight Flow Directionality

- Eight out of ten of the largest flows are inbound and only two are outbound.

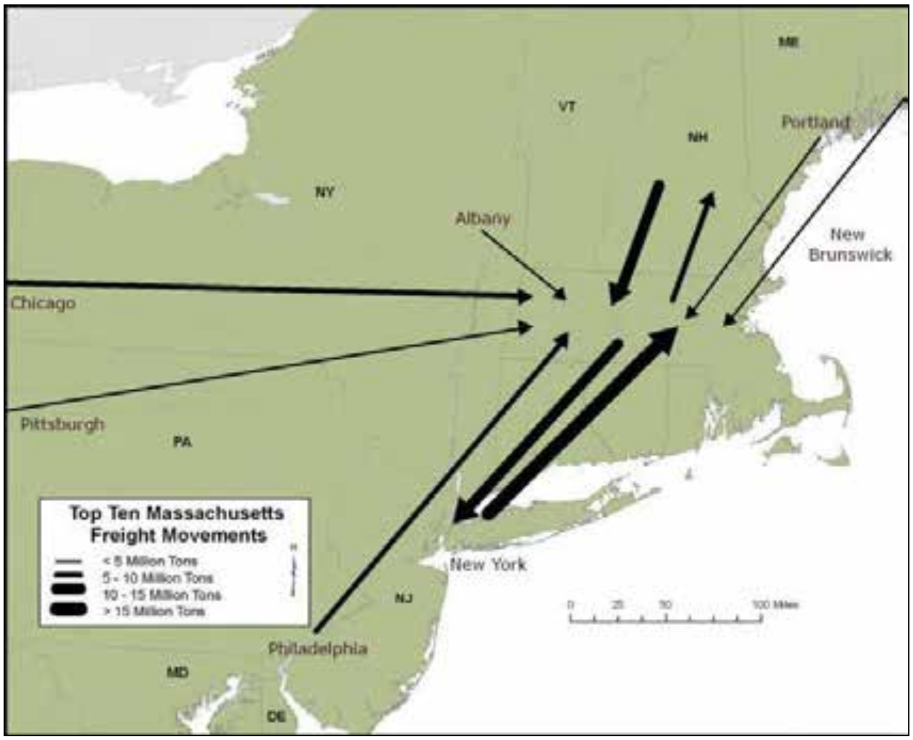
Freight Flow Origins and Destinations

- The largest freight flow is between the New York City metropolitan area (including parts of New Jersey) and Massachusetts with approximately 12.6 million tons shipped to Massachusetts per year. Of this, 77 percent is shipped by truck, 22 percent by water (barge), and only 1.2 percent is by rail.
- The reverse flow (Massachusetts to New York area) is 11.1 million tons with over 95 percent shipped by truck.
- Most other major freight flows are from New England, or the Mid-Atlantic states (the Philadelphia, Albany, and Pittsburgh areas).

Freight Flow Modal Patterns

- The flow with the highest rail mode share is from the Chicago area with over 2.1 million tons of freight rail shipped to Massachusetts and a 44 percent rail mode share.
- The freight flow with the largest water mode share is from New Brunswick, Canada with over 3.7 million tons of marine shipments dominated by petroleum products.

Figure 7: Top Ten Largest Inbound and Outbound Freight Flows for Massachusetts



Source: Global Insight TRANSEARCH 2008 Release

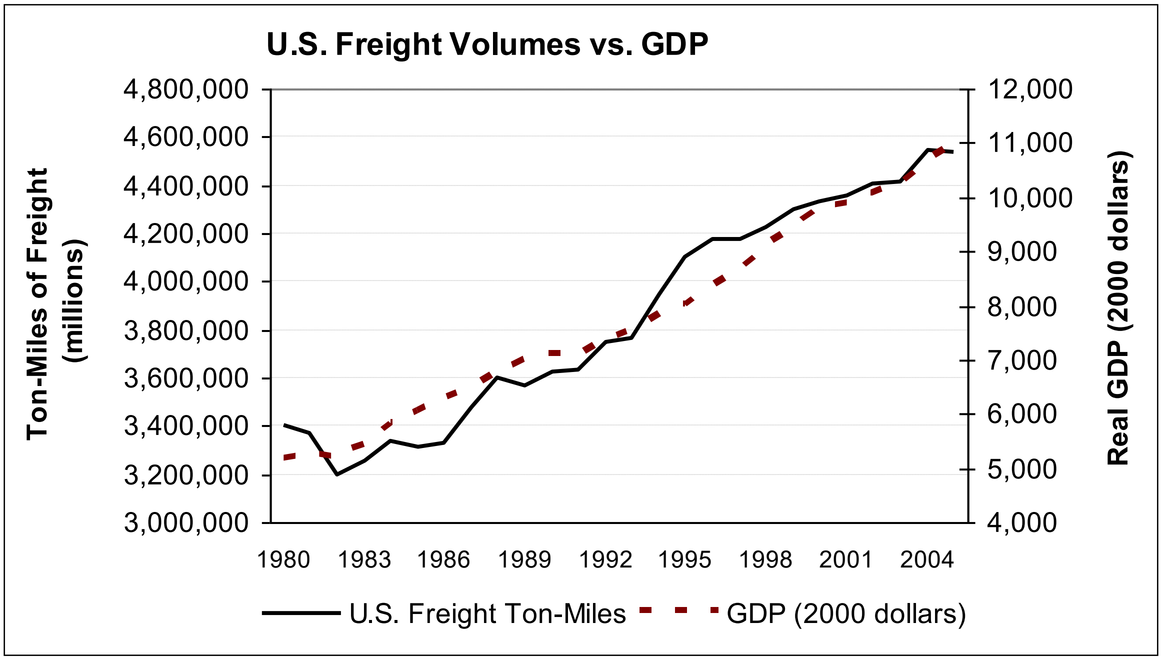
2.2.7 FREIGHT VOLUMES AND ECONOMIC GROWTH

There is a direct correlation between freight volumes and economic activity; the more economic activity in a region, the greater likelihood of significant freight flows. This relationship can be seen through a comparison of GDP and freight mileage, which follow similar growth rates, as seen in Figure 8.

Not surprisingly, the economic recession of 2008-2010 is having a negative impact on trade volumes, leading to lower TEUs at most US ports, surplus capacity of shipping vessels, and reduced shipping rates and earnings for shipping business. For example, idled ocean container capacity as of March 2, 2009, reached a record 1.35 million TEUs, with 453 ships without work.

In terms of hire rates for ships, the rates are plummeting as a 3,500-TEU gearless Panamax vessel was earning $10,500 a day in 2009, down from an average of $26,125 in 2008, according to London shipbroker Clarkson. In 2005, a Panamax ship was earning more than $38,000.

Figure 8: The Historical Relationship between US Freight Volumes and GDP



Source: US Bureau of Transportation Statistics and US Bureau of Economic Analysis

Finally, container freight volumes are consistently down for both West Coast and East Coast ports. As a sampling of West Coast ports, volumes (according to Global Insight) are down on an annual basis by 18 percent at POLALB, 22 percent at Oakland, 29 percent at Tacoma, and 39 percent at Seattle. Despite a more diversified portfolio of markets at East Coast ports, volumes are down by almost 7 percent at PONYNJ and 29 percent at Charleston, South Carolina.

2.2.8 ENVIRONMENTAL CONCERNS AND CARBON REDUCTION INITIATIVES

Related to fuel prices, the environmental impacts of transportation are being increasingly scrutinized as a mobile source of emissions and contributor to global climate change. Looming carbon taxes and associated regulatory changes are likely to impact industrial and energy production and thus also affect the freight industry. For example, coal is the largest source of energy production in the US and also one of the largest commodities in terms of rail and truck trips throughout the country. Conversions to alternative energy sources could re-distribute and/or reduce freight transportation demand for energy-related goods.

Environmental considerations will likely impact modal shares as modes vary in terms of energy efficiency. Rail and maritime shipments are much more environmentally friendly for longer hauls than truck. For example, the Federal Railroad Administration estimates that freight rail, compared to truck shipping, is 1.9 to 5.5 times more energy efficient.[15] In addition, rail produces fewer emissions per ton-mile. CSX estimates that their trains can transport one ton 423 miles on a single gallon of gas, and that using rail instead of truck results in 6.5 million fewer tons of CO_2 emissions.[16] In addition, conservation initiatives and technologies aimed at

[15] "Comparative Evaluation of Rail and Truck Fuel Efficiency on Competitive Corridors", Federal Railroad Administration, November 19, 2009.
[16] See http://www.csx.com/?fuseaction=about.environment

reducing fuel consumption, greenhouse gases, and limiting climate change will affect transportation costs.

2.3 TRUCKING AND THE MASSACHUSETTS HIGHWAY SYSTEM

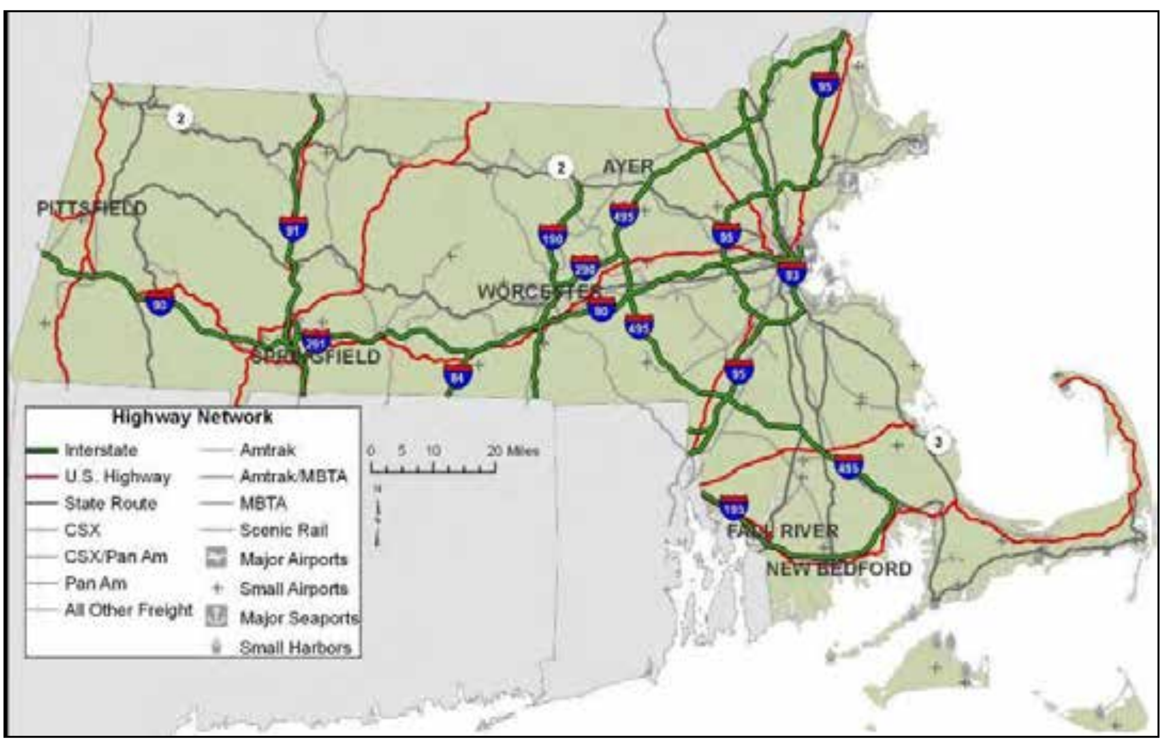
The vast majority of freight in Massachusetts travels by truck on the highway system. Even freight that is shipped by water, air or rail usually requires truck carriage to complete the movement from shipper to receiver. Consequently, a critical aspect of the Freight Plan is a thorough understanding of the existing conditions, key issues, challenges and opportunities related to freight truck activity in Massachusetts. The remainder of this section is organized into the following analyses and discussions:

- Existing conditions of the highway infrastructure;
- Truck volumes, highway congestion, and bottlenecks;
- Trucking issues; and
- Trucking opportunities.

2.3.1 EXISTING CONDITIONS OF THE HIGHWAY INFRASTRUCTURE

The Massachusetts highway system provides critical connections for the movement of goods and people within the Commonwealth and linking to the rest of the nation. The highway system is a network of limited access highways, multi-lane highways with general access, and numbered routes and major roads, all linking to the local roadway system of minor streets. This system is illustrated in Figure 9.

Figure 9: Massachusetts Highway Infrastructure System



Source: Compiled by HDR Using Mass GIS Data

Under the jurisdiction of state DOT‟s/MassDOT with oversight by the Federal Highway Administration (FHWA), the National Highway System (NHS) includes approximately 160,000 miles of roadway that has been designated as critical to the nation‟s economy, defense, and mobility. In Massachusetts, the NHS is comprised of the entire Interstate Highway System (435 centerline miles, 2,525 lane-miles, not including the Massachusetts Turnpike). These facilities include:

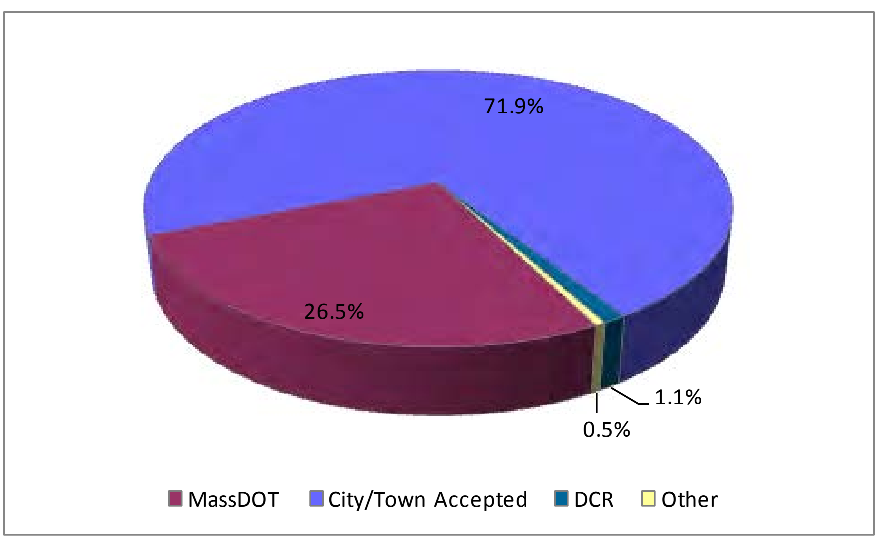
- Interstate 85 (I-84);
- Interstate 190 (I-190);
- Interstate 195 (I–195);
- Interstate 91 (I-91);
- Interstate 93 (I-93);
- Interstate 290 (I-290);
- Interstate 291 (I-291);
- Interstate 391 (I-391);
- Interstate 95 (I-95);
- Interstate 295 (I–295);
- Interstate 395 (I-395); and
- Interstate 495 (I-495).

The Massachusetts Turnpike, I-90, a toll road, is also part of the NHS. Other major highways, such as Route 3 and Route 24, and some major arterial roads such as Routes 9 and 20, are also included in the NHS for a total of an additional 1,829 centerline miles and 6,715 lane-miles of highway. This public roadway network accommodates both freight and passenger mobility needs.

2.3.2 MASSACHUSETTS ROADWAY OWNERSHIP AND OPERATIONS

Since the creation of MassDOT in November 2009, Massachusetts highway operations and maintenance are performed primarily by MassDOT (with a little bit by the Department of Conservation and Recreation (DCR). As illustrated in Figure 10 below, cities and towns also own and maintain a large segment of the public roadway network though the shares only reflect federal highway system facilities. These are primarily local roads and streets that serve local needs.

Figure 10: Massachusetts Roadway Operational Jurisdiction by Federal Aid Category



Source: Massachusetts Road Inventory Year-End Report 2009, MassDOT

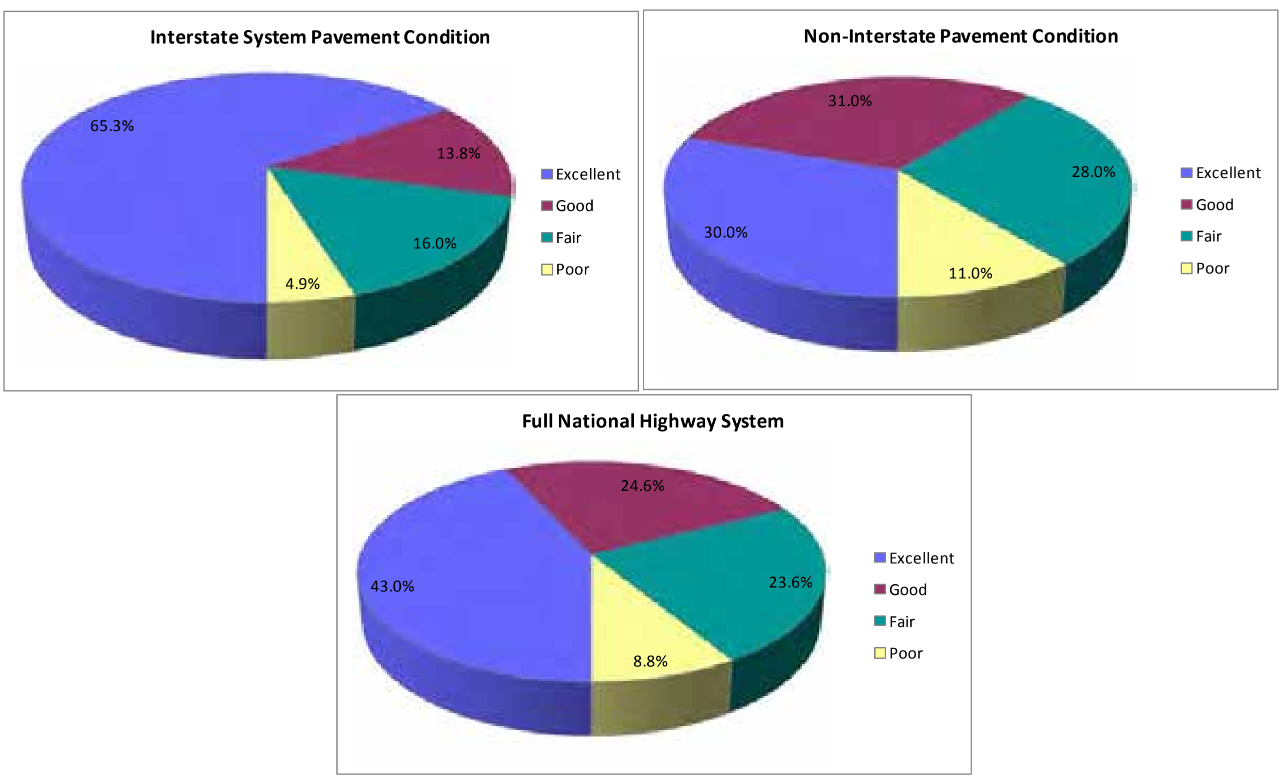
MassDOT operates and maintains most of this highway network of roads and bridges throughout the Commonwealth. This includes all interstates and NHS roads, including the Turnpike (I-90), and the Metropolitan Highway System. The Metropolitan Highway System consists of the Central Artery and related tunnels and bridges, including the Tobin Bridge that connects Boston to Chelsea and points north. The Turnpike and portions of the Metropolitan Highway System are toll facilities. The DCR operates and maintains a system of parkways in eastern Massachusetts, and contracts with MassDOT for certain functions such as snow removal.

The reorganization of multiple agencies into the new MassDOT is consistent with national trends to consolidate and organize planning and management of transportation systems that encourage and facilitate a multi-modal approach to mobility and infrastructure planning and investment.

2.3.2.1 Highway System Conditions and Maintenance

MassDOT measures the condition of pavements on the Interstate System, the National Highway System, all other roads under MassDOT jurisdiction, and on Commonwealth-numbered routes not under MassDOT jurisdiction. As shown in Figure 11, approximately 79.1 percent of the Interstate system is in "Excellent" or "Good" condition, nearly reaching the MassDOT goal of 80 percent. For the non-Interstate portion, 60.7 percent is in "Excellent" or "Good" condition. For the total NHS system, 67.6 percent is in "Excellent" or "Good" condition, slightly below the MassDOT goal of 70 percent.

Figure 11: Interstate System Pavement Conditions



Source: Mass Highway Scorecard 2009

MassDOT has implemented two significant annual efforts to improve pavement condition on major roads in the Commonwealth: The Interstate Maintenance (IM) Program and the National Highway System Preservation Program.

The annual IM Program is comprised of several projects on interstate highways totaling $75 million. Each year, the projects are selected after a careful analysis of measured pavement condition and expected deterioration using sophisticated pavement management computer models. Emphasis is placed on utilizing optimal pavement preservation techniques applied at the right time during the pavement life cycle to optimize pavement condition and minimize total cost. In addition to pavement preservation, each of the IM projects includes improvements to other highway features such as bridges, guardrail, and drainage systems so that all the work on a particular portion of road is done at the same time, minimizing traffic impacts.

Similarly, the $15 million annual NHS Preservation Program is comprised of projects on the NHS system. Pavement condition is a critical issue for trucking because better pavement condition reduces trucking costs for repairs and improves travel efficiency, and freight trucks generate greater wear and tear on highway facilities than lighter vehicles with estimates indicating that freight trucks account for 63 percent of pavement damage, accelerating pavement reconstruction and rehabilitation schedules.[17]

2.3.2.2 Bridge Conditions and Maintenance

Massachusetts" highway bridges are a critical link in the Commonwealth"s highway infrastructure. Based on input from MassDOT, FHWA reported that as of December 2007 there were 5,018 bridges in the Commonwealth of Massachusetts. Of that total, 2,572 are either structurally deficient or they are functionally obsolete. A structurally deficient bridge is a bridge deck, superstructure, substructure, and/or culvert that is in poor condition. A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if a waterway below frequently overtops the bridge during floods.

A functionally obsolete bridge is not structurally deficient, but has an outdated design. These may have lower load carrying capacity, narrower shoulders or less clearance than bridges built to current standards.

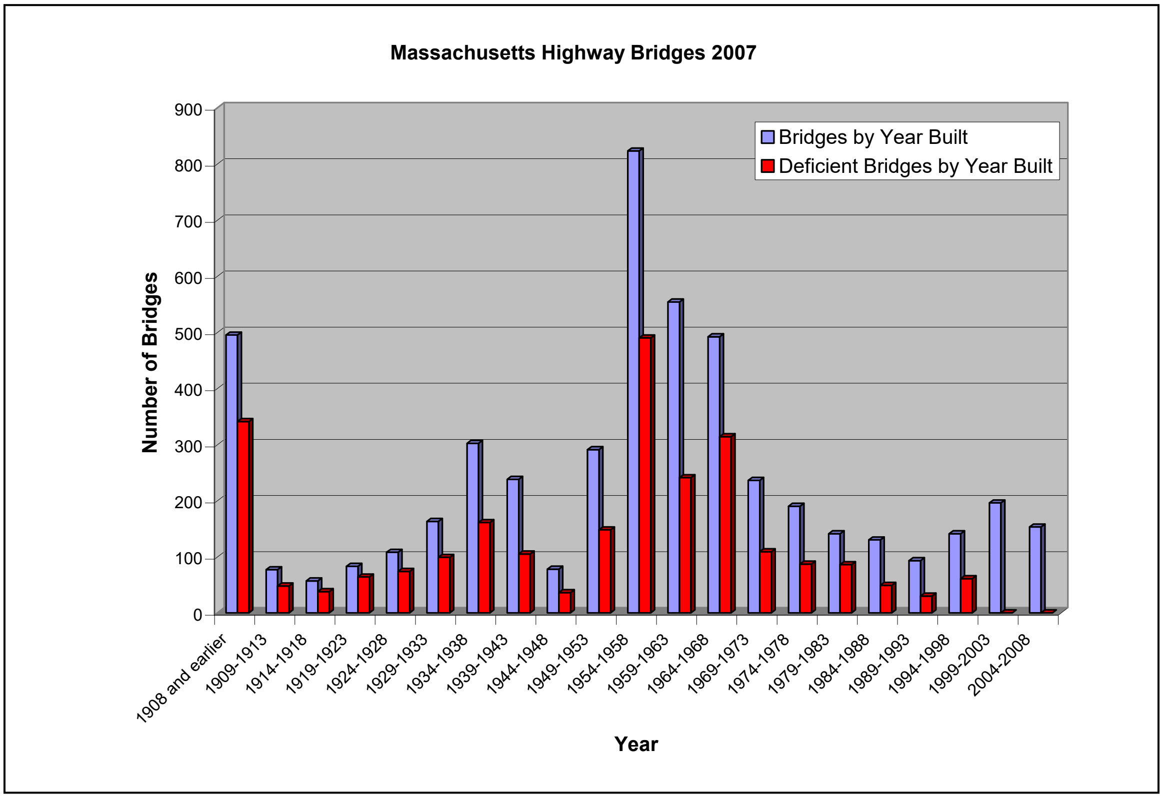
Approximately 585 bridges or 11.7 percent of all bridges are structurally deficient in Massachusetts, and 76.3 percent of all structurally deficient bridges were built prior to 1958. Meanwhile, approximately 1,987 or 39.6 percent are functionally obsolete and of those, 57.8 percent of all obsolete bridges were built prior to 1958. Figure 12 illustrates the number of bridges by year built in comparison to the amount of currently deficient bridges.[18] As discussed below, Massachusetts has developed the Accelerated Bridge Program (ABP) to address these deficiencies. The ABP represents a historic investment in Massachusetts bridges of nearly $3 billion to accelerate the improvement and condition of bridges in every corner of the Commonwealth. This program will greatly reduce the number of structurally deficient bridges in

[17] ECONorthwest "Highway Cost Allocation Study 2007-2009 Biennium" Salem Oregon: Oregon Department of Administrative Services, Office of Economic Analysis, 2009.

[18] The FHWA established a "10-year rule" for determining a bridge's eligibility for Highway Bridge Replacement and Rehabilitation Program (HBRRP) funding after construction or major reconstruction has taken place. The rule prevents a bridge from remaining in a deficient classification after major reconstruction and thereby affecting the bridge fund apportionments to a State. The FWHA rates the bridges on a one hundred scale sufficiency rating system. If a bridge is structurally deficient or functionally obsolete with a sufficiency rating of less than 50, it qualifies for replacement using federal bridge funds.

the Commonwealth, improve safety, and create thousands of construction jobs on bridge projects.

Figure 12: Massachusetts Bridge Deficiencies



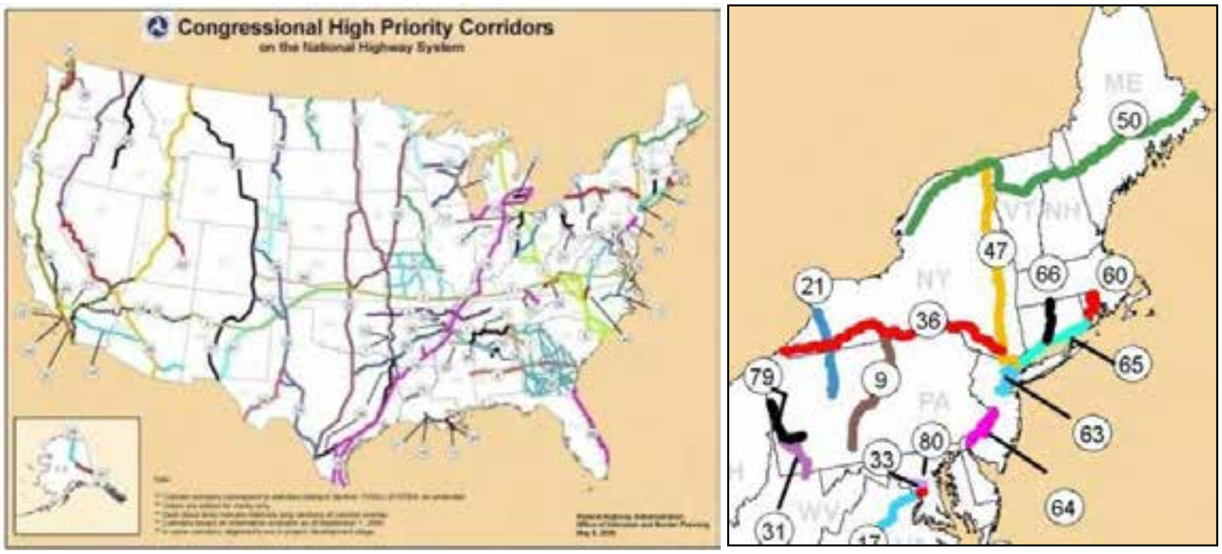
Source: Federal Highway Administration, 2007

2.3.2.3 Major Freight Trucking Corridors

Freight trucking volumes tend to be largest on select key highway corridors in Massachusetts, namely the Interstate highway system. From a broader regional perspective, "High Priority Corridors" on the NHS established by the US DOT under provisions of SAFETEA-LU in the greater New England and New York area feed into Massachusetts" major freight corridors and impact passenger movement, freight flows and evacuation routes.[19] Of note, officially designated high priority corridors are not within Massachusetts. However, some of these designated corridors have the potential to extend into Massachusetts in the future and clearly are related to freight flows on I-90, I-95, I-91 and other highways (see Figure 13).

[19] http://www.fhwa.dot.gov/planning/nhs/hipricorridors/index.html

Figure 13: National Freight High Priority Corridors



Source: US Department of Transportation, September 2006

The officially designated High Priority Corridors in the region include:

i. **Number 47 –** Interstate Route 87 Corridor from New York City to the Quebec border;

ii. **Number 65 –** Interstate Route 95 Corridor in Connecticut beginning at the New York state line through Connecticut to the Rhode Island state line;

iii. **Number 66 –** Interstate Route 91 Corridor from New Haven, CT, through Hartford to the Massachusetts state line;

iv. **Number 50 –** East-West Corridor commencing in Watertown, New York, continuing northeast through New York, Vermont, New Hampshire, and Maine, terminating in Calais, Maine; and

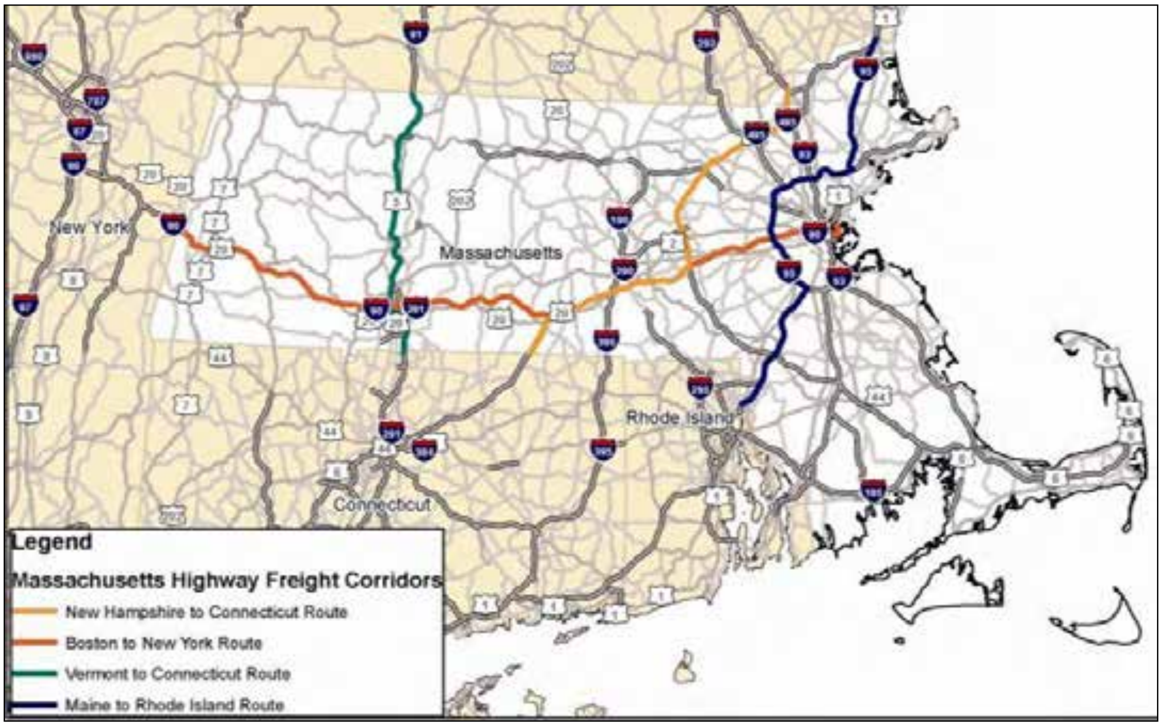
v. **Number 60 –** Providence Beltline Corridor beginning at Interstate Route 95 in the vicinity of Hope Valley, RI, traversing eastwardly intersecting and merging into Interstate Route 295, continuing northeastwardly along Interstate Route 95, and terminating at the Massachusetts border. This identified corridor also includes the western bypass of Providence, RI, from Interstate Route 295 to the Massachusetts border.

As noted, many of these routes extend into Massachusetts. These routes are expected to experience increasing volumes in coming years, and the resultant increases in congestion will have serious environmental and economic consequences. Thus, the federal designation may help to devote additional resources to addressing these serious issues, to the ultimate benefit of the Commonwealth.

Although trucking volumes dominate goods movement, truck traffic continues to be a relatively small portion of total vehicle miles traveled statewide and a relatively small share of traffic volumes on most highways. However, as demonstrated in the trade flow analyses in Chapter 3, there are a number of corridors that carry much of the truck traffic that serves the

Commonwealth‟s businesses and consumer needs. The Commonwealth‟s major highway freight corridors connect Massachusetts to New York, Vermont, New Hampshire, Maine, Connecticut, and Rhode Island and the rest of the continental US and Canada. While truck routes differ depending on specific origins and destinations, some of the most common truck routes are shown in Figure 14.

Figure 14: Massachusetts Highway Freight Corridors



Source: Compiled by HDR Using Mass GIS Data

The major routes for freight moving to, from and through the Commonwealth, measured by freight tonnage, include:

i. The **New Hampshire to Connecticut** route connects northern New England to the Atlantic Coast and follows I-95 and I-93 from points north to I-495 then to I-90 (or via I–290) west to Sturbridge, connecting to I-84 and south into Connecticut and then onto I-95 into the Mid-Atlantic region.

ii. The **Boston to New York** route provides a direct route on the Massachusetts Turnpike (I-90), and connects metropolitan Boston, the Route 128 and I-495 crescent regions and central and western Massachusetts to upstate New York and beyond to Canada, the Midwest and beyond.

iii. The **Vermont to Connecticut** route follows I-91 from Canada and Vermont south into the Pioneer Valley in Massachusetts connecting into Connecticut and I-95.

iv. The **Maine to Rhode Island** route follows I-95 from all Maine points to and around Boston and the southeast region of MA into Rhode Island. This route also feeds into the Atlantic Coast region.

Quickly growing in importance to freight movement, especially within the Commonwealth, are the interstates north and south of Worcester, I-190 and I-395.

2.3.2.4 Truck Terminals and Distribution Facilities

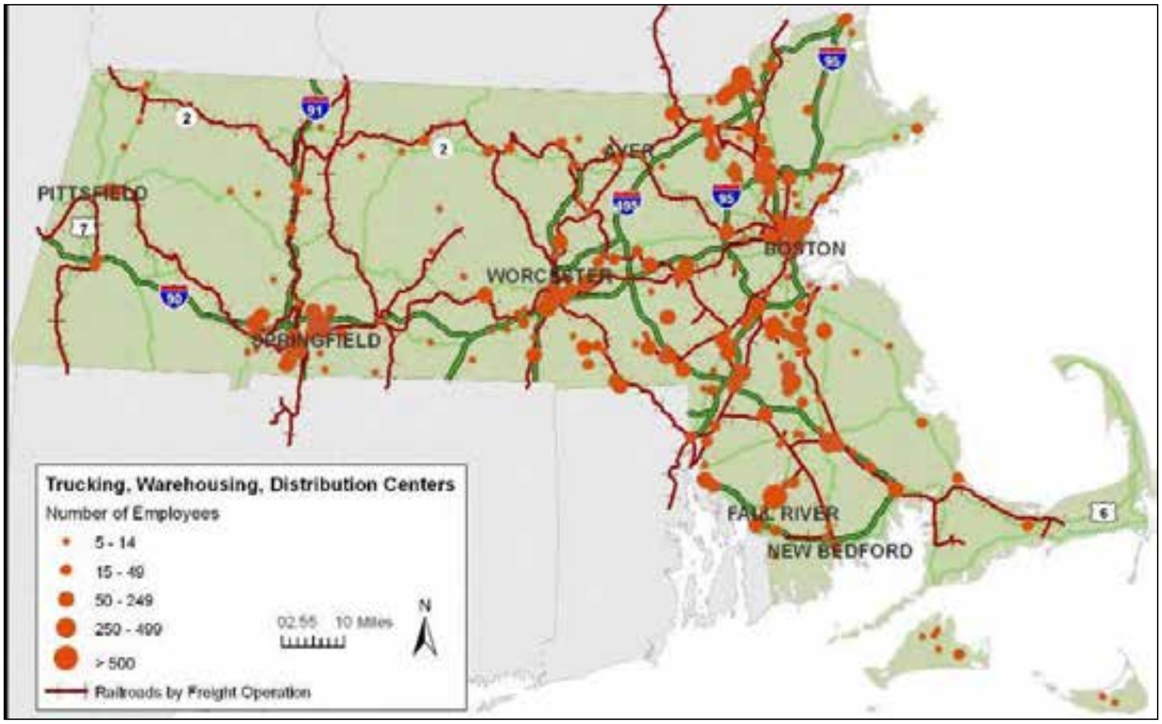
Trucking in Massachusetts is vital to the economic well-being of the Commonwealth, and serves many businesses with door-to-door services. Trucking also provides the "last mile" link for multi-modal shipments, connecting rail, air and ship terminals with the customer. Key components of this trucking system are the trucking terminals and distribution facilities that provide interfacing, warehousing, and connectivity to ultimate shippers and receivers.

Similarly, major freight traffic generators include manufacturing facilities, warehouse operations and distribution centers, as well as larger retail trade sites. Freight may be inbound raw materials, or outbound finished products. Secondary freight shipments (goods for local delivery from distribution centers and warehouses) are actually the largest type of freight trucking activity in Massachusetts by tonnage. With one of the country"s highest per capita incomes and major metropolitan markets, Massachusetts is a large consumer of goods resulting in much more inbound freight than outbound shipments. The Commonwealth is thus heavily dependent on local and regional distribution activities. These products often travel cross country, or from origins in the South or Midwest. The long haul nature of this trucking contributes to the growing congestion on the main routes of I-90, I-95, I-84 and I-495.

Massachusetts has a wide variety of distribution centers, warehouses, truck terminals, and related freight facilities (see Figure 15). These facilities are most often located along major roadways with the largest clusters in the Boston, Worcester, and Springfield areas. Historically, distribution centers were located in the urban core of major cities like Boston to directly serve large local markets and areas in or near Boston continue to have a large number of smaller warehouse facilities. For example, major freight truck distribution facilities are often located near the Route 128 and I-495 circumferential highways. Additional distribution facilities are located in central and western Massachusetts to take advantage of north-south and east-west connectivity of I-90, I-91 and I-84.

The current trend is to locate larger-scale distribution centers along major highway routes outside of urban centers and sometimes out-of-state leading to longer truck hauls into Massachusetts. These large-scale distribution centers receive large volumes of freight by rail or truck (or by marine containers) and are then transloaded for regional and local delivery to wholesalers or retail outlets. This trend is predicted to be the future model for freight transportation for all modes of freight transportation. The prevalence of these facilities near major highways outside of Boston reflects this trend. Most facilities serve a single mode but multi-modal terminal operations are growing in importance in the Commonwealth.

Figure 15: Massachusetts Freight Distribution Centers and Warehousing Facilities



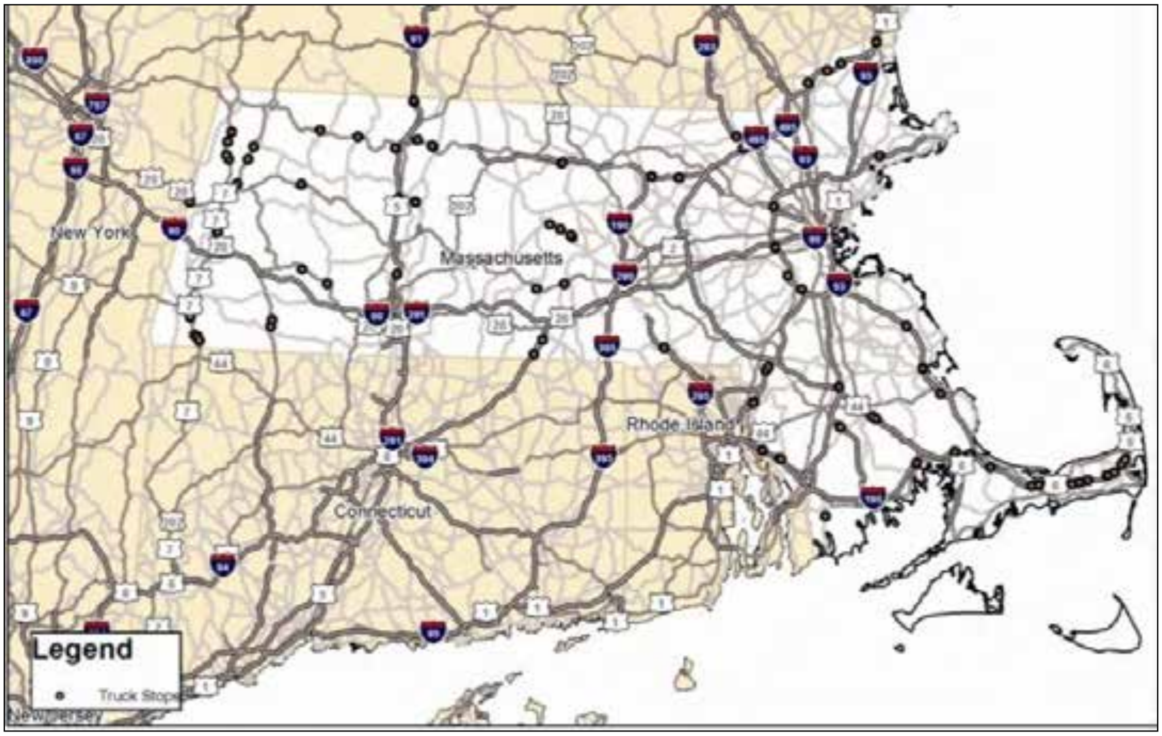
Source: InfoUSA data and HDR calculations

This shift has been accelerated by growing traffic congestion and increasing land values in the urban core that have contributed to the relocation of freight terminals and distribution centers away from the core metropolitan region. The increased use of intermodal services nationally means that the long haul is more often provided by cost-effective rail and maritime carriers, leaving the "last mile" delivery to local trucking firms. Massachusetts does receive a higher proportion of freight by water than the national average, but these materials are then handled by truck to their final destination. This factor is one of the key reasons why over 90 percent of all freight shipments in the Commonwealth are moved by truck.

2.3.2.5 Truck Stops

Truck stops and rest areas are an important element of the highway system. These facilities contribute to safety and efficiency of the trucking operations in the Commonwealth. Based on stakeholder feedback, truck stops in Massachusetts are not adequate to meet current needs – with truckers often expanding these areas by parking on entrance and exit ramps to the sites, or on shoulders in the vicinity of the rest areas. Unlike other states, there are presently no rest areas in Massachusetts with electrical connection capabilities to eliminate the idling required to maintain heat or air conditioning in parked sleeper cabs, which have environmental benefits.

Figure 16: Massachusetts Truck Stops and Rest Areas



Source: MassDOT

2.3.2.6 Truck Routes and Hazardous Materials

Freight trucking is subject to regulations related to the size, weight, and commodities being carried. Consequently, identified and designated truck routes are a critical aspect of freight trucking. In particular, some highway routes can limit or eliminate trucks over a certain size, and the transport of hazardous materials can also be restricted on highway segments. Hazardous Materials are defined as any substance or material that could adversely affect the safety of the public, handlers, or carriers during transportation. Improper transportation of hazardous materials (hazmat) such as explosive, flammable, or oxidizing material can cause explosions and fires if they are accidentally released. Also, there are hazardous materials that can have short or long term effects on humans and the environment such as radioactive, toxic, corrosive, or infectious materials. Minimizing the threat of these substances and materials being released in confined spaces are the primary focus of the Commonwealth.

Transportation of hazardous materials must comply with Title 49 of the Code of Federal Regulations (CFR). The Federal Hazardous Materials Regulations give guidance on how individual states should restrict routes for hazmat transportation by avoiding populated areas, places crowds assemble, narrow streets or alleys. For example, CFR 397.67 requires that the transportation of hazardous material shall not operate through an extended underground roadway.

A list of routes where Hazmat materials are prohibited by MassDOT is provided in Table 3.

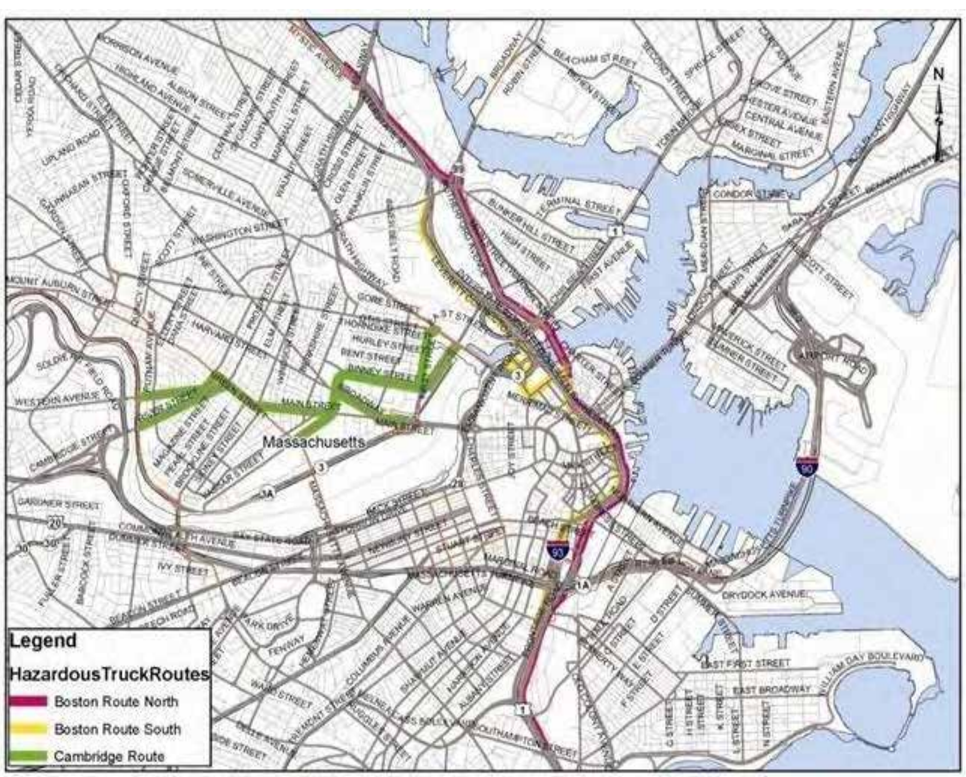
Table 3: Hazmat Restricted Routes

Designated Date	Route Description	Hazardous Materials Description
11/13/94	Callahan Tunnel- Route 1A Northbound under Boston Harbor Tunnel	All Hazmats
12/01/95	Charlestown Tunnel from Interstate 93 to Charlestown	All Hazmats
11/13/94	Interstate 90 – Ted Williams Tunnel under Boston Harbor	All Hazmats
11/13/94	Interstate 90 – Prudential Tunnel from Dalton Street to Clarendon Street (including interchange 22)	All Hazmats
11/13/94	Interstate 93 – Dewey Square Tunnel from Sumner St. to Kneeland St.	All Hazmats
11/13/94	Sumner Tunnel – Route 1A Southbound under Boston Harbor	All Hazmats
11/13/94	US 1 Northbound and Southbound Tunnels in Boston (aka I-93)	All Hazmats

Source: Massachusetts Turnpike Authority 2009

Due to these route restrictions, there are three designated hazardous material routes to allow carriers to bypass the restricted routes above. The three routes are designated as Boston Route North, Boston Route South, and Cambridge Route as shown below.

Figure 17: Hazardous Material Truck Routes



Source: Massachusetts Turnpike Authority

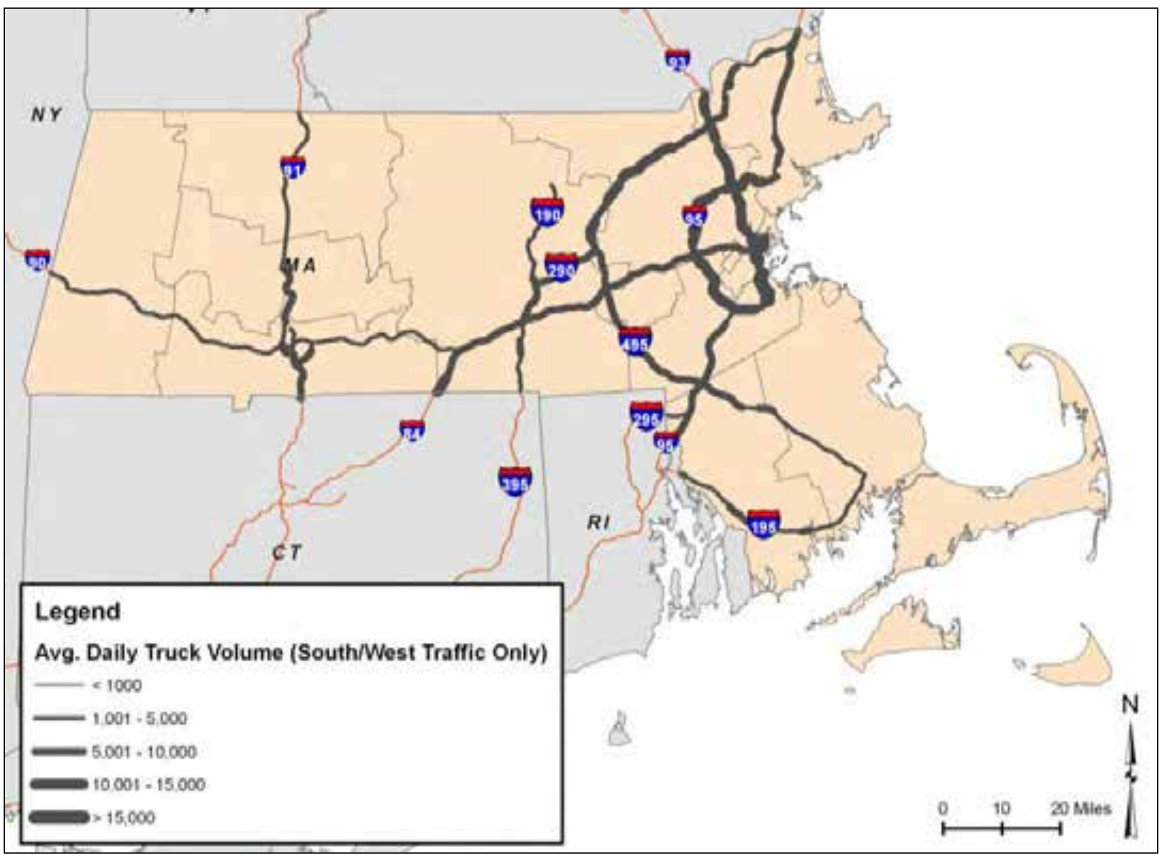
In addition, some municipalities have established truck exclusion zones that create serious impediments to the flow of goods with the metropolitan region. Stakeholders requested that MassDOT establish equitable rules related to the establishment and enforcement of truck exclusions.

2.3.3 TRUCK VOLUMES, HIGHWAY CONGESTION, AND BOTTLENECKS

2.3.3.1 Truck Volumes by Corridor

With freight tonnage volumes highest on Interstate routes, Figure 18 displays the truck volumes by Interstate highway route in Massachusetts. Several points are helpful for understanding truck volumes and its role in congestion. Even though inbound volumes of freight by tonnage are much greater than outbound volumes, the truck volumes are almost identical for these different directional flows. This is due to at least two factors: a) trucks traveling back empty or not full; and b) the lighter, high-value nature of Massachusetts products. Additionally, daily truck volumes cover the full range of trucks from the largest tandem-trailers to smaller commercial trucks delivering products into urban areas. This analysis is different from the earlier trade flow analysis that was strictly based on tonnage but verifies that highest truck volumes are concentrated along the I-95/Route 128 corridor as well as I-93 near Boston.

Figure 18: Average Daily Truck Volumes on MA Interstates (South/West Bound Traffic)

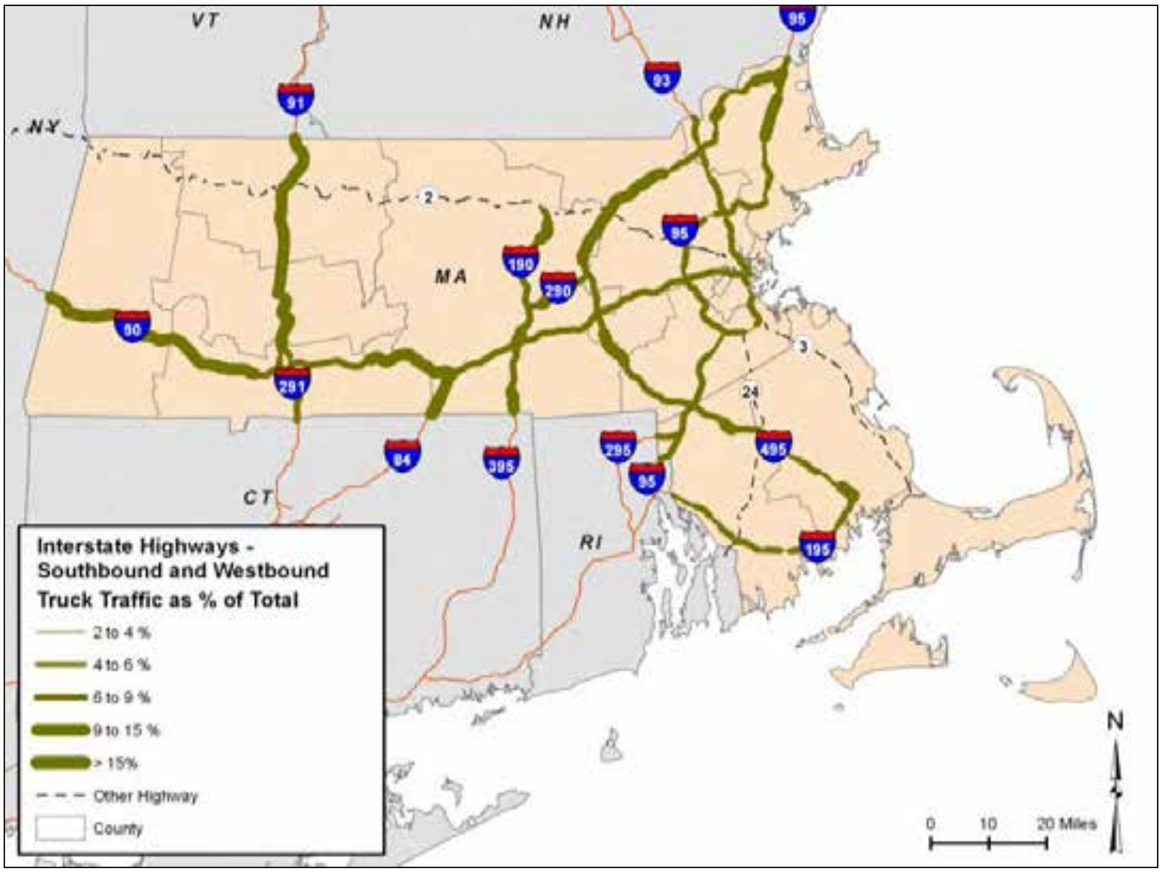


Source: Massachusetts Highway Performance Monitoring System (HPMS) data

A further analysis of truck volumes is provided by comparing percentage of trucks to total daily traffic volumes on Massachusetts Interstate facilities (see Figure 19). As a percentage of total traffic, truck volumes tend to be in the four to six percent range or less on highways from I-

95/Route 128 east, reflecting the large volumes of commuters and other non-truck travel in that part of the Commonwealth. Corridors with the highest truck volumes as a percentage of all traffic include I-91, parts of I-495 and I-90, I-84, and segments within central, southeastern and northeastern Massachusetts. The truck percentage can reach over 15 percent of all traffic depending on the corridor, with the statewide average along the Interstates in the six to nine percent range.

Figure 19: Average Daily Truck Volumes as a Share of All Traffic (South/West Bound Traffic)



Source: Massachusetts Highway Performance Monitoring System (HPMS) data

These volumes reflect current usage, and reinforce the importance of these major corridors to commerce and development. Truck volumes have been growing significantly and this growth has been accommodated on existing infrastructure that is quickly reaching its design capacity (vehicles per day), and future demand for goods movement will further exacerbate the already constrained capacity of the system.

2.3.3.2 Highway Congestion

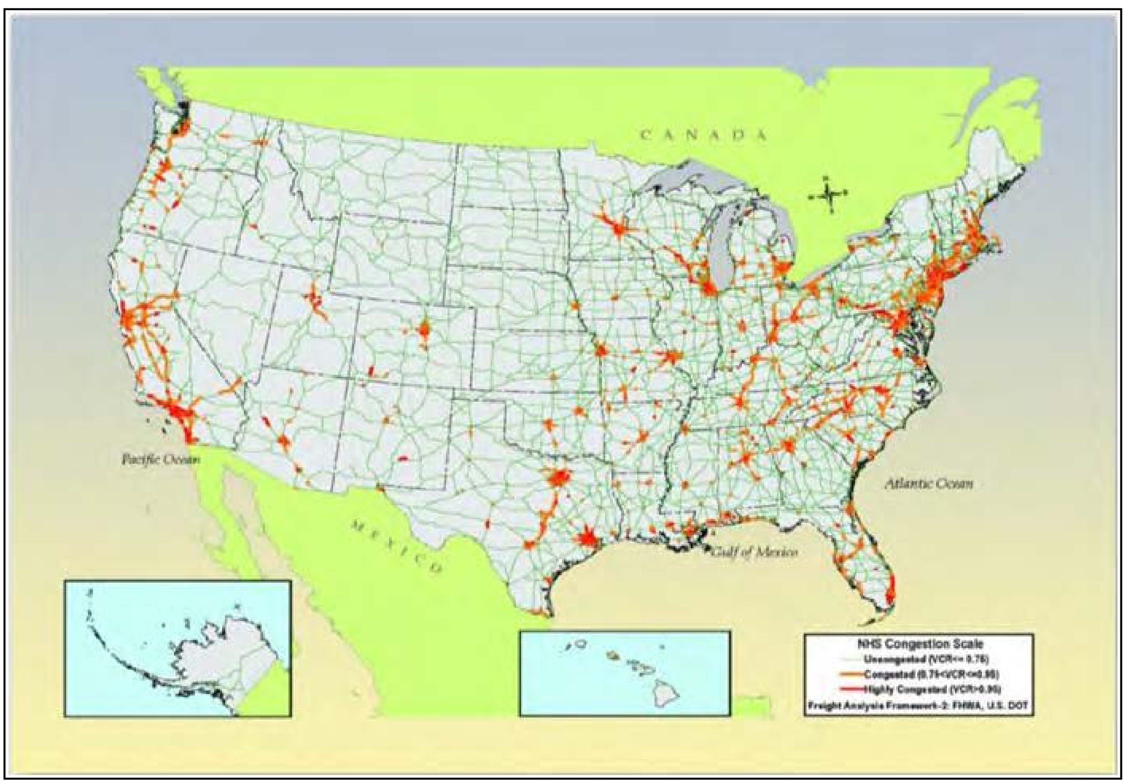
National and Regional Highway Congestion Trends

The issue of growing congestion on the nation"s highways and local roadway networks has been highlighted in numerous national reports and publications. A report by The Road Information Program (TRIP), entitled "*Rough Roads Ahead*" (May 2009) examined the condition of major roads in the nation"s most populous areas, and concluded that:

- The condition of the nation"s critical metro area roads and highways are getting worse, thereby increasing vehicle maintenance and travel costs for motorists.
- Boston ranks 8th among urban areas found with the greatest share of substandard roads and highways. Forty-nine percent of Boston area roads are in substandard condition.
- The high level of pavement deterioration is a result of increased traffic, particularly from large vehicles such as trucks. Overall traffic on urban roads increased by 41 percent between 1990 and 2003, but commercial truck traffic on urban roads grew 58 percent during the same time period.
- By 2020, vehicle miles of travel (VMT) across the nation is expected to grow by 40 percent. Heavy truck VMT is expected to grow by 47 percent.

A FHWA analysis, as illustrated in Figure 20, shows that in the northeastern states growth in demand outpaces growth in capacity. Given the environmental and permitting challenges of expanding the highway system, many states encourage alternative modes of mobility to meet the growing demand. Multi-state solutions are being explored through organizations such as the I-05 Corridor Coalition and AASHTO to improve operations through Intelligent Transportation Systems (ITS) and encourage goods movement by rail and water.

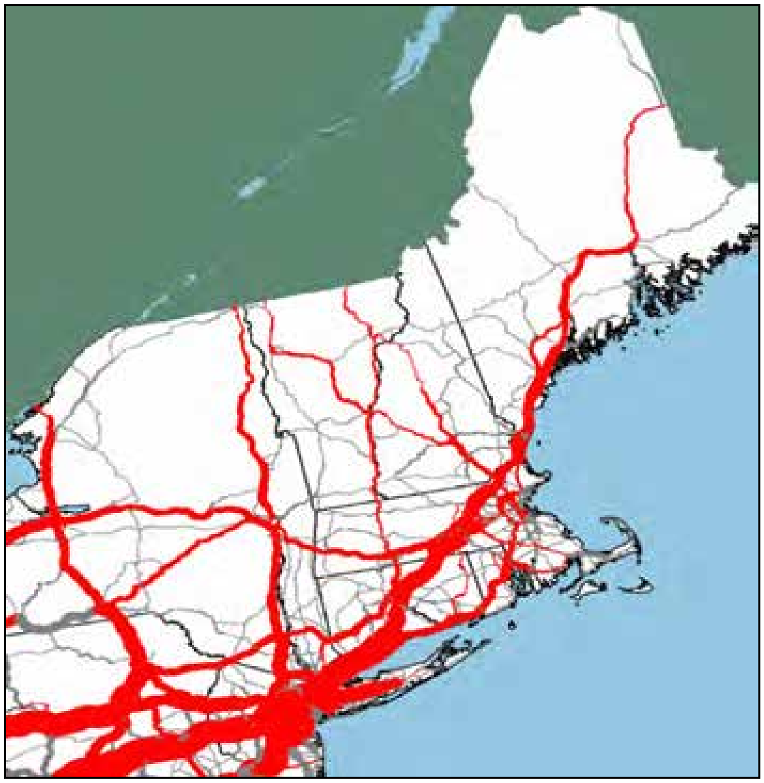
Figure 20: NHS Congestion Levels



Source: Federal Highway Administration

Northeast regional long-distance truck flows in 2002 are presented in the map below (Figure 21), highlighting the very heavy volumes in the New York metropolitan area with the largest flows in Massachusetts traveling along I-90, I-84, I-290, and I-495.

Figure 21: Average Daily Long-Haul Freight Truck Traffic on the National Highway System in New England and the Northeast, 2002



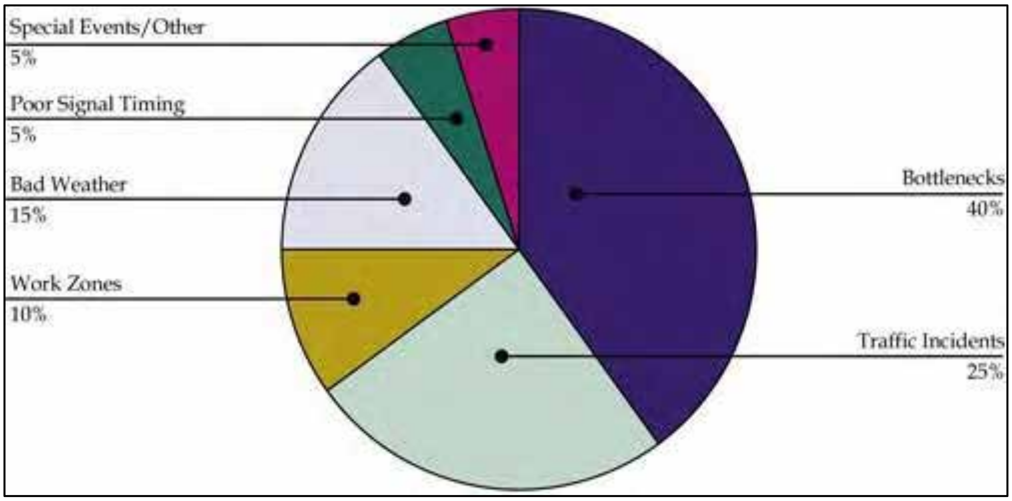
Source: FHWA Freight Analysis Framework

Although Massachusetts has a significant number of freight facilities and distribution centers, significant volumes of products, especially consumer products for retail trade, are delivered to ports in New York, New Jersey or Montreal, or delivered to distribution super centers in the mid-Atlantic states, and then trucked into the region. Rail shipments from southeastern US locations are also often transloaded to truck in the region south of New York City, thus contributing to the increased highway congestion on I-95 and I-84, especially between New Jersey/Pennsylvania and eastern Massachusetts.

The US DOT projects strong freight volume growth over the next twenty years with 98 percent growth for trucks and 88 percent for rail from 2002 to 2035.

As shown in Figure 22, freight and passenger highway congestion is due to a combination of factors including: increased demand for goods, longer commuter trips, poor geometric design of interchanges and roadways, bad weather, work zones, and traffic incidents. The number of additional automobiles on the road increases annually and the roadway infrastructure capacity is not increasing at the same rate. The free flow of commerce via the highway system is often stymied by the ever-increasing amount of commuter traffic.

Figure 22: National Sources of Congestion



Source: http://www.ops.fhwa.dot.gov/aboutus/opstory.htm

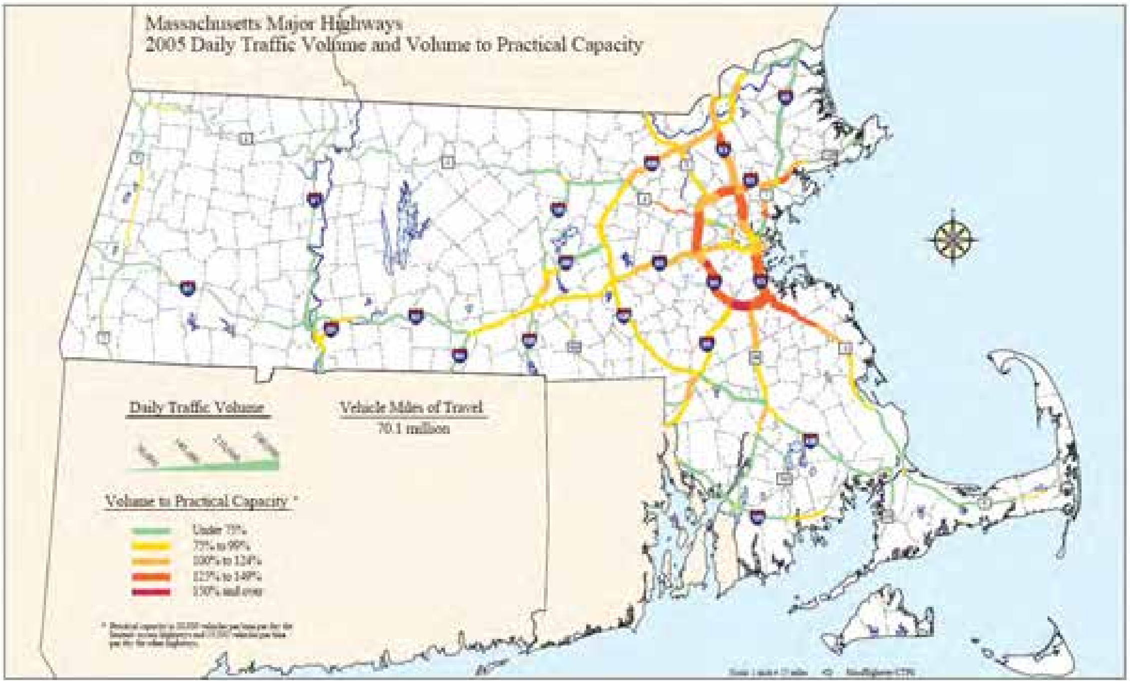
Highway Congestion on the Massachusetts Highway System

MassDOT reports that congestion levels on the Commonwealth‟s roadways have been increasing. Several noted trends from this report are:

- Between 1990 and 2000, there was a 14 percent increase in VMT on Massachusetts roads (or 6 billion additional miles on interstate highways and arterials and 800 million additional miles on local roads).
- Highway capacity (supply) is anticipated to increase far less than VMT (demand) in the future. This condition underscores the challenge of accommodating growing traffic demand with a fixed supply of roadway capacity.

FHWA has projected congestion impacts for both passenger and freight vehicles to increase significantly in the metropolitan Boston region and statewide. These conditions result in both time delays for all travelers and increased costs for goods movement. The 2005 levels of congestion on various key segments of the Commonwealth‟s highway system are illustrated in Figure 23.

Figure 23: Massachusetts Highway Congestion Levels, 2005



Source: MassDOT Scorecard, 2009

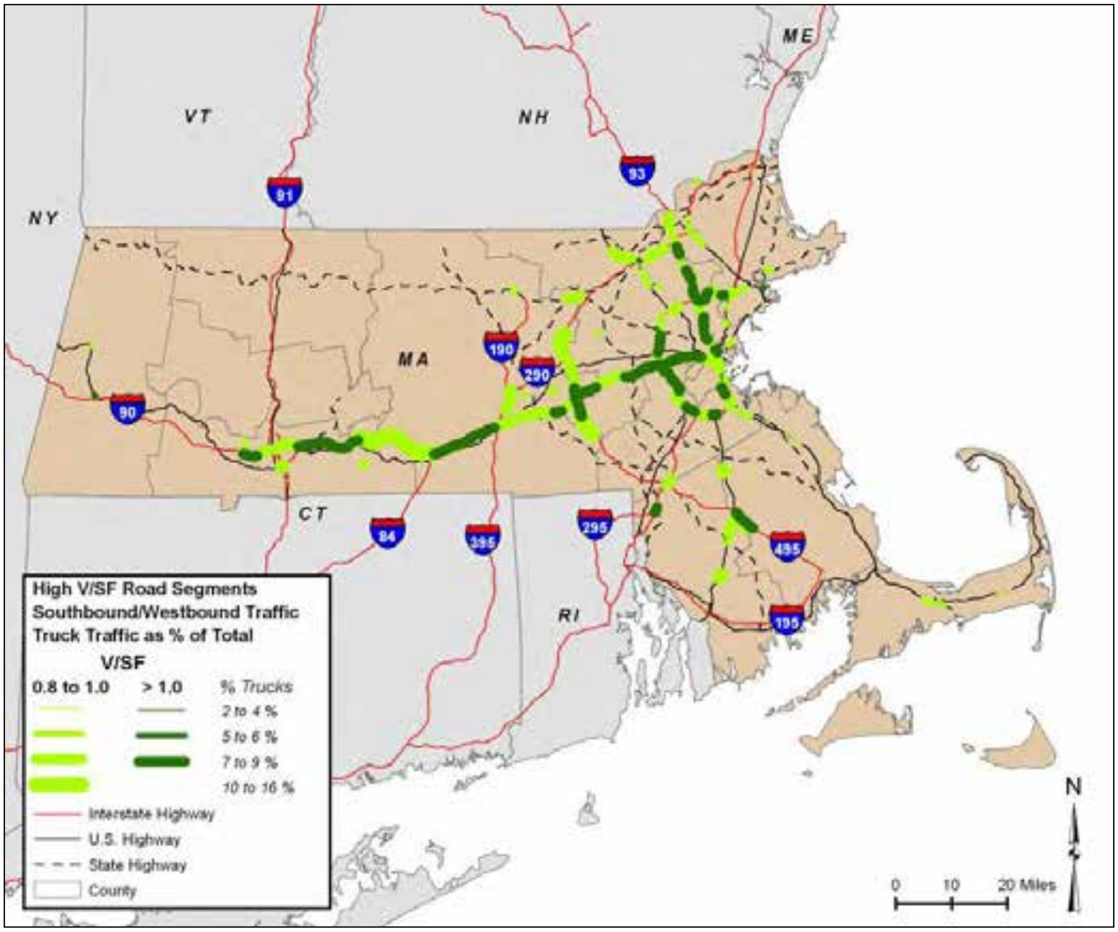
Congestion on the roadways impacts the economy, public health and air quality, costs for highway maintenance, and lost hours for drivers sitting in traffic. The Texas Transportation Institute‟s (TTI) Urban Mobility Report ranked the Boston metropolitan area as number 12 in the nation for congestion delays. The Springfield metropolitan area was also covered in this report and it was estimated that congestion leads to almost 2.5 million gallons of fuel wasted, over 4 million hours of person delay, and a congestion cost per person of $198.

Congestion has severe impacts on freight mobility. Truck delays have an estimated cost of $77 per hour of delay. This impacts the business that rely in trucks and ultimately the consumers who pay more for consumer products due to increased transportation costs.

Figure 24 provides a two-dimensional analysis of truck volumes and highway congestion with dark green highway segments representing facilities with volumes beyond capacity (V/SF greater than 1.0) and light green segments nearing capacity. The thickness of the green lines thus represents the truck share of traffic on those segments. Interestingly, of the most congested highways in the Commonwealth (dark green), truck volumes do not exceed 9 percent of total volumes.

There is an obvious concentration of truck volumes along I-90 and the connecting roadways meaning that automobile drivers face higher levels of truck traffic on these routes. These are some of the same routes that are suffering from ever increasing volumes of traffic and congestion. Some of the areas for concern include most sections of I-93, I-90 from about Westfield to Boston, sections of I-495, I-290, and I-95 as well as some other select truck bottlenecks near Lee and Pittsfield, along Route 2 near intersections with I-495 and I-190, and sections of Route 3 and Route 24.

Figure 24: High V/SF Road Segments With Truck Traffic as Percent of Total



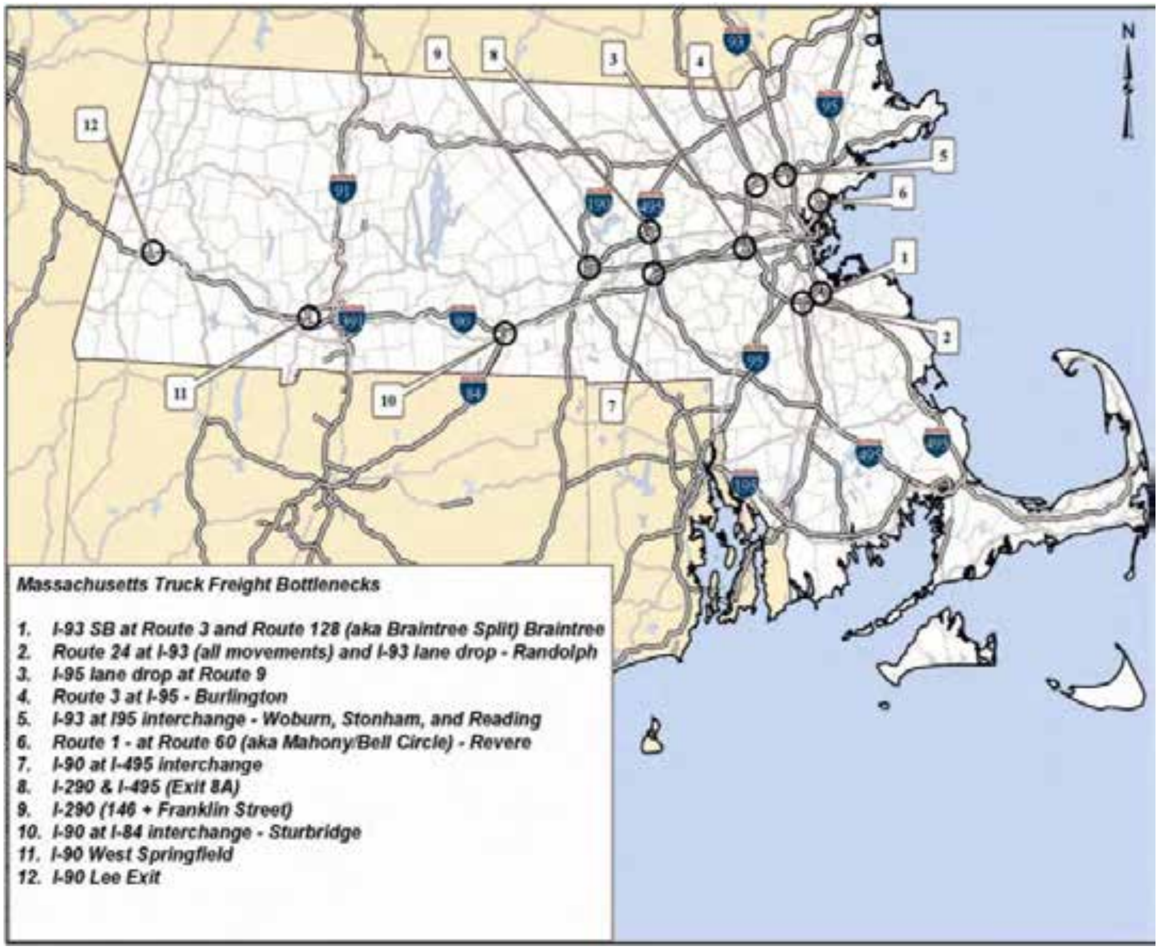
Source: Massachusetts Highway Performance Monitoring System (HPMS) data

2.3.3.3 Highway and Truck Bottlenecks

As congestion has grown and investment in infrastructure has been delayed, specific locations within the highway network have become severely congested "bottlenecks." These bottlenecks are specific locations where traffic flow is restricted due to geometry, lane drops, weaving, or interchange-related merging maneuvers. The recurring congestion at these bottlenecks is a cause of public concern to both drivers and the public agencies responsible for the operations and maintenance of the system.

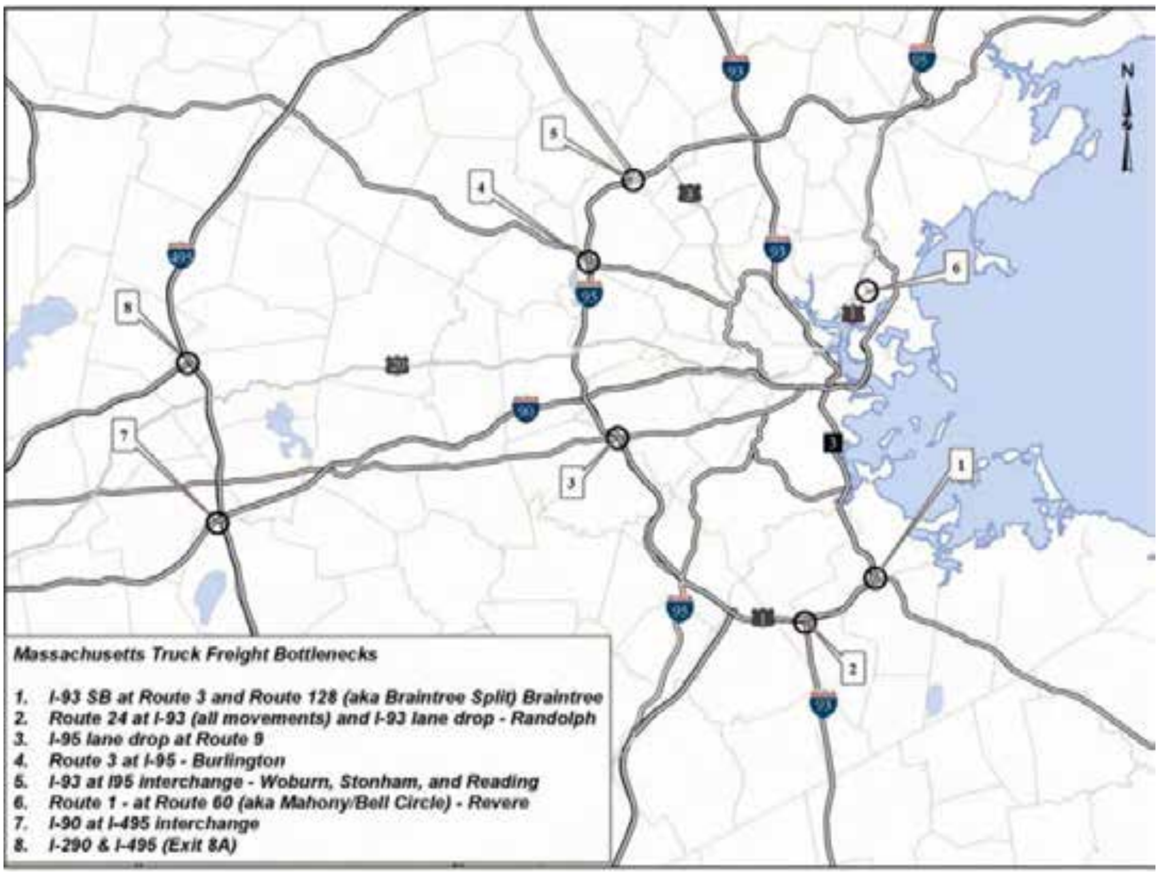
MassDOT has completed a preliminary identification of key bottlenecks at interchanges throughout the Commonwealth. Many of these locations have been the focus of studies and alternatives analysis. Figures 25 and 26 identify a set of key statewide and Boston metropolitan area truck bottlenecks that combine high overall congestion with key truck corridors.

Figure 25: Highway Freight Bottlenecks in Massachusetts



Source: MassDOT, 2009

Figure 26: Highway Freight Bottlenecks in Massachusetts – Greater Boston Area



Source: MassDOT, 2009

Highway Freight Bottlenecks in Massachusetts

Consistent with the maps above, the following roadway facilities experience daily recurring congestion, often are locations of accidents and other traffic incidents that exacerbate delays, and seriously impede freight flows on a regular basis.

1. **I-93 SB at Route 3 and Route 128 (a.k.a. Braintree Split)**
   Braintree I-93 SB and Route 128 are operating at 125 percent to 149 percent volume to practical capacity.
2. **Route 24 at I-93 (all movements) and I-93 lane drop (Randolph)**
   South of the intersection, Route 24 is operating at 100 percent to 124 percent volume to practical capacity. East of the intersection, I-93 is operating at 124 percent to 149 percent, while west of the intersection, I-93 is operating at 150 percent and over volume to practical capacity.
3. **I-95 lane drop at Route 9 (Wellesley)**
   I-95 is operating at 150 percent and over volume to practical capacity at the intersection with Route 9. North of the intersection of Route 9, to the intersection with I-90, I-95 is operating at 75 percent to 99 percent. South of the intersection with Route 9, to the I-93 split, I-95 is operating at 100 percent to 124 percent volume to practical capacity.

4. **Route 3 at I-95 (Burlington)**
   Route 3 and I-95 are operating at 75 percent to 99 percent and 100 percent to 124 percent volume to practical capacity at intersection or fours, respectively.
5. **I-93 at I-95 interchange (Woburn, Stoneham, and Reading)**
   I-95 north and south of the interchange is operating at 125 percent to 149 percent volume to practical capacity. I-93 north of the interchange is operating at 125 percent to 149 percent over volume to practical capacity. I-93 south of the interchange is operating at 100 percent and over 124 percent over volume to practical capacity.
6. **Route 1 at Route 60 (a.k.a. Mahoney/Bell Circle)**
   Route 1 at the Route 60 interchange is operating at 125 percent to 149 percent volume to practical capacity. Route 1 north of the interchange is operating at 100 percent to 124 percent, and under 75 percent volume to practical capacity south of the intersection.
7. **I-90 at I-495 Interchange**
   I-90 and I-495 west of the interchange are operating at 75 percent to 99 percent volume to practical capacity.
8. **Interstate 290 and Interstate 495 Exit 8A**
9. **Interstate 290 at Route 146 Franklin Street**
10. **I-84 and I-90 Interchange**
    I-84 and I-90 west of the interchange are operating under 75 percent volume to practical capacity, while I-90 east of the interchange is operating at 75 percent to 99 percent volume to practical capacity.
11. **I-90 West Springfield**
12. **I-90 Lee Exit**

2.3.4 TRUCKING ISSUES

The issues identified and described in this section are based on analysis of available data; input from truckers, shippers, and receivers; input from a series of regional public meetings and focus groups; and the professional observations of the study team.

The key issues related to trucking in the Commonwealth include:

- Bottlenecks, recurring congestion, and limited opportunities for capacity expansion;
- Roadway conditions, design and geometry;
- Relocation of distribution centers (warehouses, transload facilities) from older urban cores to suburban locations along the interstates;
- A lack of modern rest area facilities and adequate space for trucks;
- Route restrictions due to bridge conditions;
- Overweight and hazardous materials route restrictions; and
- Energy and environmental impacts.

2.3.4.1 Bottlenecks, Recurring Congestion and Limited Opportunities for Capacity Expansion

Recurring congestion is caused by daily volumes of passenger vehicles and trucks that exceed capacity on roadways, especially during peak periods. Massachusetts trucking companies have identified congestion as a factor in the high cost of trucking operations in the Commonwealth. Peak-period congestion results in traffic slowing below posted speed limits on major segments of the major truck routes and creating stop-and-go conditions within multiple areas of Massachusetts, most noticeably in the Boston metro area.

Beyond capacity expansions, other options to improve the operations of the existing infrastructure include increasing the truck size and weight allowances for heavier loads, and programs for quicker incident response time to accidents and other incidents as a means of limiting the impact of non-recurring congestion. Northern New England states are increasingly aware of truck size and weight regulations as an impediment, especially related to trade with Canada that allows larger trucks, and are considering "harmonization" efforts to make the regulations more consistent across states. It is worth noting that heavy trucks contribute disproportionately to pavement deterioration and that these proposals would likely impact roadway conditions and future highway maintenance costs.

2.3.4.2 Roadway Conditions, Design and Geometry

MassDOT reported that in 2007, nine percent of Massachusetts" national highway system (NHS) roads were rated in poor condition and an additional 27 percent were in fair condition. Roads rated in poor condition often have significant rutting, potholes or other visible signs of deterioration. Roads in poor condition typically need to be resurfaced or reconstructed. Roads rated in fair condition often show signs of significant wear and may also have some visible pavement distress. Most pavements in fair condition can be repaired by resurfacing, but some may need more extensive reconstruction to return them to good condition.

These highway conditions impact all travelers including freight shipments as autos and trucks experience increased operating costs, including added fuel and insurance costs, and delays in transit for delivery to customers.

Poor pavement conditions result in further deterioration as heavy trucks negotiate the ruts and potholes, causing further damage. A factor in delays to goods movement in Massachusetts is the overall age of the Commonwealth"s highway network. Especially in the eastern third of Massachusetts, sections of the highway system are over 100 years old with many interchanges and intersections not meeting current design standards. The Commonwealth has sought to address these deficiencies, but many of these projects remain to be addressed. As mentioned above, the negative consequences of heavy trucks, including proposals to expand truck size and weight, do contribute significantly to increased pavement damage in excess of their share of trips on the highways.

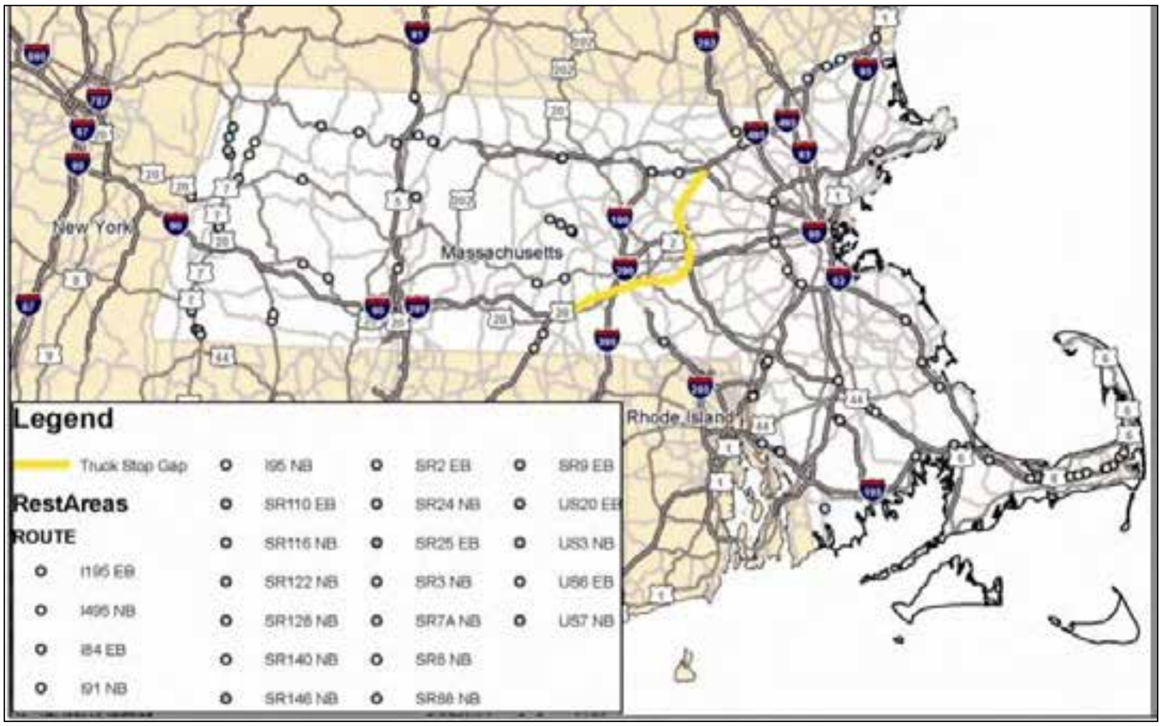
2.3.4.3 A Lack of Modern Rest Area Facilities and Adequate Space for Trucks

The trucking community has identified the shortage of highway rest stop facilities for trucks as a key factor in addressing goods movement to and from the Commonwealth. Truck stops along the Commonwealth"s highway network are generally inadequate in size and scope – lacking adequate space and amenities. Facilities at such truck stops should provide adequate parking, plug in power to avoid long term idling, and sanitary facilities.

There is an important gap in the rest stop network in Massachusetts (see Figure 27). The section of I-495 from Westford through to I-90 at Westborough and onto Sturbridge has been identified as a key issue by the trucking community. The challenge is not the numbers of rest stops, but rather how effective these are in meeting the freight mobility needs of Massachusetts shippers and receivers of goods. This particular gap has been identified as impeding the flow of goods between northern New England and the mid-Atlantic Coast, and more importantly on a local basis, to truckers seeking to avoid getting caught in peak commuter congestion as they seek to serve customers in the metropolitan areas of Boston, Worcester, and Springfield.

This situation results in a conflict for drivers between complying with federal hours-of-service regulations (which limit the number of hours per day that truck drivers can drive) or parking in illegal, possibly dangerous locations such as ramps and shoulders. The parking shortage also affects congestion since drivers with early morning deliveries typically stay overnight just outside the metropolitan region and stage their deliveries by driving in before rush hour. There are inadequate facilities for this system to work effectively in Massachusetts.

Figure 27: Truck Rest Stop Areas and Gap in Facilities



Source: Massachusetts Office of Geographic and Environmental Information (MassGIS)

2.3.4.4 Route Restrictions Due to Bridge Conditions and Municipal Regulations

Municipal and Commonwealth truck route restrictions impose operational constraints on the free flow of goods within Massachusetts. Many of these restrictions are imposed due to weight restrictions on bridge decks, vertical clearances under bridges, municipal truck exclusion zones, and hazardous cargo regulations. As noted in a focus group session with the Massachusetts trucking industry, a key issue is that some of these route restrictions are in conflict at town lines, creating nearly impossible compliance. Lack of clear and concise information available to truckers contributes to costly delays and fines.

As discussed in the existing infrastructure conditions section, Massachusetts faces a serious challenge with over 50 percent of the Commonwealth‟s bridges rated as structurally deficient or functionally obsolete.

The Commonwealth‟s regional planning agencies and Metropolitan Planning Organizations (MPOs) have targeted such key bridge projects as high priority for repair – and many of these projects have been included in the State‟s Transportation Improvement Program (STIP). In the past, funding did not keep pace with the need, which was one a major factor in developing the Commonwealth‟s Accelerated Bridge Program (ABP) to address these deficiencies.

Bridge weight limits can result in circuitous detours for heavy trucks, impacting both trucking productivity and the secondary and local road networks that become alternative routes. These route restrictions can also limit access to current and future industrial sites and intermodal terminals. Thus, it is important to continue to take good care of the Commonwealth‟s highway and bridge infrastructure.

2.3.4.5 Overweight and Hazardous Materials Route Restrictions

The trucking community and their customers identified overweight truck route restrictions and hazardous materials route restrictions as impediments to efficient goods movement operations, especially in core urban areas. One of the key challenges is related to containerized goods entering the Commonwealth at the Port of Boston when the containers carry heavy loads beyond local and Commonwealth allowances. These goods need to be delivered to inland distribution centers but because of the lack of well-defined freight truck routes, the containers either need to be reconfigured to a lower weight or risk a fine for overweight travel. Thus, additional and more appropriate overweight-truck routes serving the Port of Boston would improve the efficiency of freight operations, as shippers report they would be able to use fewer trucks to move the same amount of freight. Current regulations, of both the City of Boston and the Commonwealth, require that if a load is divisible or reducible, it must be. Examples of non-reducible loads include oversize steel or concrete beams, and blocks of frozen food, typically fish.

Hazardous materials restrictions in tunnels are recognized as essential for safety however, the classification of certain products as hazardous presents special challenges to the trucking community. Moving certain products from the Port to locations within the metropolitan area often requires a long and circuitous route that some advocates claim offers no safety enhancement. The additional truck miles leads to more fuel consumption and pavement damage.

2.3.4.6 Relocation of Distribution Centers from Older Urban Cores to Suburban Locations along the Interstate

An important issue facing Massachusetts trucking operations is the relocation of freight distribution centers from more traditional urban core sites to more dispersed locations away from the urban core and largest consumer markets thus impacting trucking patterns for final delivery of goods. Similar to impacts on railroads, these land use changes alter how trucking firms meet customer needs. This subject is discussed further in the land use development section of Chapter 3.

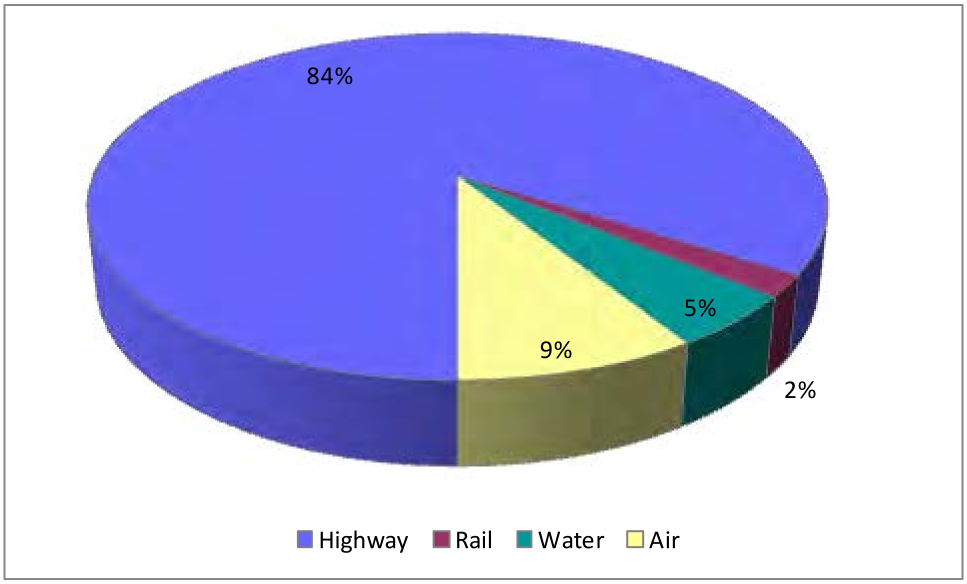
2.3.4.7 Energy and Environmental Impacts

The recent and projected growth in freight truck volumes is also an issue in terms of the impacts of trucking on energy consumption and environmental effects.

Energy

In 2007, the transportation industry accounted for 28.5 percent of energy consumed in the United States.[20] Nationally, the highway mode comprised 84 percent of the energy consumption of the transportation sector.

Figure 28: Energy Consumption by Transportation Mode



Source: United States Department of Energy, "Transportation Energy Data Book", Edition 27, 2007-2008

Air Quality and Emissions

According to 2007 EPA data, as shown in Table 4, total US greenhouse gas emissions were 7,882 billion tons of carbon dioxide equivalents, with transportation accounting for 28 percent. The vast majority of transportation-related greenhouse gas emissions are due to fossil fuel consumption. Trucking accounted for 23 percent of the total transportation GHG emissions.

[20] United States Department of Energy, "Transportation Energy Data Book", Edition 27, 2007-2008.

Table 4: United States Greenhouse Gas Emissions (GHGs)

US Greenhouse Emissions by Economic Sector			US Greenhouse Gas Emissions from Transportation		
Economic Sector	**Billions of Tons CO_2 Eq.**	**% of Total**	**Economic Sector**	**Billions of Tons CO_2 Eq.**	**% of Total**
Electrical Power Generation	2,695	34%	Trucking	453	23%
Transportation	2,199	28%	Freight Railroads	56	3%
Industry	1,528	19%	Waterborne Freight	43	2%
Agriculture	554	7%	Pipelines	39	2%
Commercial	450	6%	Aircraft	25	1%
Residential	391	5%	Recreational Boats	19	1%
US Territories	64	1%	Passenger railroads	7	0%
Total	**7,882**	**100%**	On Road Vehicles	1,368	68%
			Total	**2,010**	**100%**

Source: EPA, Inventory of US Greenhouse Gas Emissions, 1990-2007, April 15, 2009, Tables ES-7, A-100 and A-101
Note: Totals for transportation do not match due to inconsistency in quantification.

AASHTO projects that ton-miles for truck movements that are more than 500 miles long will increase from 1.40 trillion in 2000 to 2.13 trillion in 2020. If 10 percent of truck traffic went by rail – perhaps via efficient intermodal movements involving both railroads and trucks, cumulative estimated GHG reductions from 2007 to 2020 would be 210 million tons. Transportation sector carbon dioxide emissions in 2007 were 431.8 million metric tons higher than in 1990, an increase that represents 44 percent of the growth in unadjusted energy-related carbon dioxide emissions from all end-use sectors over the period.[21] Petroleum combustion is the largest source of carbon dioxide emissions in the transportation sector, as opposed to electricity-related emissions in the other end-use sectors.

2.3.5 TRUCKING OPPORTUNITIES

While there are significant challenges and issues related to freight trucking in Massachusetts, there are opportunities as well. These include:

- The Massachusetts Accelerated Bridge Program;
- The federal stimulus funds for transportation through the American Recovery and Reinvestment Act;
- Multi-state regional partnership opportunities such as the I-95 Corridor Coalition; and
- Targeted regulatory, policy, and investment initiatives to improve truck operations and reduce bottlenecks.

Massachusetts Accelerated Bridge Program

In August 2008, Governor Patrick signed legislation creating the Accelerated Bridge Program (ABP). The ABP represents a monumental and historic investment in Massachusetts bridges. Over the next 8 years, nearly $3 billion in funding will be accelerated to improve the condition

[21] Emissions factors based on calculations from the World Resource Institute and Carbonfund.org.

of bridges in every corner of the Commonwealth, including well-known bridges such as the Whittier Bridge on the key I-95 freight corridor. This program will greatly reduce the number of structurally deficient bridges in the Commonwealth, improve safety, and create thousands of construction jobs on bridge projects.

MassDOT is implementing this intensive effort to overcome the past deferred maintenance of bridges and this effort is planned to reduce the number of deficient bridges by 15 percent over the next 8 years. This effort will reverse a trend of the past several decades, and will enhance the highway network‟s ability to meet the needs of freight mobility in the future.

ARRA Funded Projects

The 2009 American Recovery and Reinvestment Act (ARRA) led to additional federal funding for transportation improvement projects. MassDOT is taking full advantage of this opportunity and is implementing a plan that integrates projects identified in several Transportation Bond Bills, and the ABP to make unprecedented investments in addressing many long-standing needs in fixing the transportation system.

Massachusetts received authority under ARRA to spend $437.9 million over two years on road and bridge projects. An additional $319 million will fund urban and regional transit projects. The stimulus spending includes numerous re-surfacing and other highway improvements that will benefit freight trucking, as well as rail system improvements that will benefit freight rail (as discussed in Chapter 5 federal funding programs for rail). Details on MassDOT‟s ARRA projects and initiatives are found online at: http://www.massdot.state.ma.us/recovery/.

Multi-State Partnerships

MassDOT continues to be active in several key multi-state partnerships including the I-95 Corridor Coalition, Northeast Association of State Transportation Officials (a regional sub-set of AASHTO), the New England Governors Council (NEGC), the Coalition of Northeast Governors (CONEG), and several emerging coalitions with Connecticut, Vermont, New Hampshire and Maine.

As noted in the discussion of freight flows, good movement in Massachusetts is dependent on the national and regional highway networks. Congestion in metropolitan New York has a direct impact on Massachusetts businesses waiting for goods to arrive, or seeking to get goods to market in that region. These multi-state partnerships encourage a balanced, regional approach to addressing operational issues, planning for capital improvements and seeking appropriate funding mechanisms to address issues of mutual concern.

New Truck Stop Locations

Truck stop locations and capacity are essential to meet the volume, legal regulations, and fueling needs for safe and efficient truck operations. Consideration for environmental improvements will include technologies to reduce idling at truck stops.

Truck Bottlenecks and Strategic Capacity/Operational Enhancements

MassDOT is progressing on a number of targeted highway investment projects that will add capacity to the highway system, address key bottlenecks, and improve the flow of freight trucks. These projects include:

- Widening of Route 128/I-95 from the Mass Turnpike (I-90) to I-93 on the southern side of the beltway;

- Intelligent Transportation System (ITS) improvements on I-91 in the Pioneer Valley;
- Replacing the current traffic signal intersection at Crosby"s Corner on Route 2 in Concord with a limited access system for continuous traffic flow; and
- Major interchange improvements at I-495 and I-290, I-95 and I-93 north of Boston, and I-495 at Marston Street. Ramp reconstruction projects include I-91 in Northampton and the I-495 South on-ramp from Route 40.

MassDOT has also identified key highway bottlenecks that contribute to inefficiencies in goods movement and exacerbate overall congestion. These locations will be examined for potential strategic investment to address capacity and/or operational improvements to reduce these bottlenecks. Strategic capacity enhancements will explicitly recognize that passenger auto travel is typically the primary cause for bottlenecks but that benefits to freight movement will also be a critical consideration in potential enhancements.

2.4 THE MASSACHUSETTS FREIGHT RAIL SYSTEM

In spite of Massachusetts" long-established rail network, freight rail is a relatively small portion of the goods movement to and from the Commonwealth. Unlike highway infrastructure, which is primarily publicly-owned, the majority of freight rail infrastructure is privately-owned.

Increased goods movement coupled with the congestion of the highway system has resulted in increasing awareness of the importance of rail for goods movement, and increased recognition by public officials at the national and state levels of the benefits of providing an efficient, integrated multi-modal infrastructure system. This section of the Freight Plan provides a description of the existing overall freight rail transportation system within Massachusetts, which includes:

- A summary of statewide freight rail statistics and historical information;
- An inventory of the ownership of the freight rail system in Massachusetts;
- A review of the major freight rail lines and facilities operating within the Commonwealth;
- The identification of freight rail facilities operating within Massachusetts, such as major rail yards, intermodal terminals, transload facilities and seaports;
- An identification of the freight rail system"s constraints, issues and bottlenecks within the Commonwealth; and
- Opportunities to improve freight rail in Massachusetts.

2.4.1 SYSTEM DESCRIPTION

The Massachusetts and New England rail system had their origin in the early 1820s, and played substantive roles in the economic development of the region and the country. Today, that system is reduced from its maximum size prior to highways funded by the federal government and built and maintained by the Commonwealth government, a system that overtook the once dominant role of the railroads in providing mobility for freight and people.

2.4.1.1 Statewide Summary

To place the current Massachusetts railroad system in perspective, Table 5 compares some basic metrics with some neighboring states. Because of the relatively tight geography of New England and the longer distance nature of freight rail, the six New England states can also be combined to create a “New England” system as shown below.

Table 5: Benchmarking Massachusetts and New England Freight Rail Operations Comparison with Other Northeastern States

State	Rail Miles	National Rank of Annual Carloads	Land area (Sq. mi.)	2008 Population (Mil)	Annual Tons (Mil)	Annual Carloads	Carloads per mile
MA	952[22]	28	7,840	6.5	9.7	318,975	271
ME	1,151	42	30,865	1.32	6.3	79,332	69
NH	415	34	8,968	1.32	1.5	16,571	40
VT	590	38	9,250	0.62	1.6	24,100	41
CT	330	38	4,845	3.5	3.4	38,452	117
RI	87	49	1,045	1.05	0.6	9,108	105
"New England"	3,525	"12"	62,813	14.3	23.1	486,538	138
NY	3,528	5	47,214	19.49	74.1	1,759,710	499
PA	5,139	1	44,817	12.45	123.3	1,982,977	386
NJ	993	19	7,417	8.68	43.5	1,434,930	1,445
MD	759	34	9,774	5.63	34.8	502,068	661

Source: Association of American Railroads (AAR) 2006 annual statistics

National rank assigned by AAR based on total miles in each state. The New England entry is based on combining the six New England states. Annual tons refer to total freight rail tonnage volume originating, terminating, or moving through each state.

Massachusetts provides a key link between freight rail traffic into the entire New England region. The large majority of freight rail into southern New England comes through Massachusetts via the CSX and PAS gateways over the Hudson River, as does a significant portion of the traffic destined for the three northern New England States. It is important to note that there are no freight rail lines crossing the Hudson River south of these CSX and PAS gateways. Thus, all traffic moving from west and south of the Hudson River to/from Massachusetts must use these gateways. Through intermodal and automotive terminals and bulk rail to truck facilities, even more regional traffic is handled via rail in Massachusetts.

Massachusetts railroads carry a wide variety of products for their customers. Freight traffic by rail into the Commonwealth includes: paper and pulp, food and farm products, coal, construction materials, automobiles and small trucks, chemicals, and manufactured goods (consumer products). Outbound traffic includes: mixed freight, solid waste, scrap paper, scrap steel, auto shredder residue, and construction and demolition material as well as finished paper goods.

As demonstrated in the trade flow analysis contained later in this section, the volume of rail varies dramatically by shipping pattern. For example, inbound shipments to the Commonwealth are the largest volume of freight rail, reflecting the large consumer markets, especially in eastern Massachusetts. The second largest volume of rail activity is for through-trips that start and end outside of the Commonwealth, such as paper shipments from Maine destined for Mid-Atlantic States. While these trips provide minimal direct benefit to

[22] If trackage rights for the MBTA system were included for Massachusetts, the rail miles would increase to 1,175.

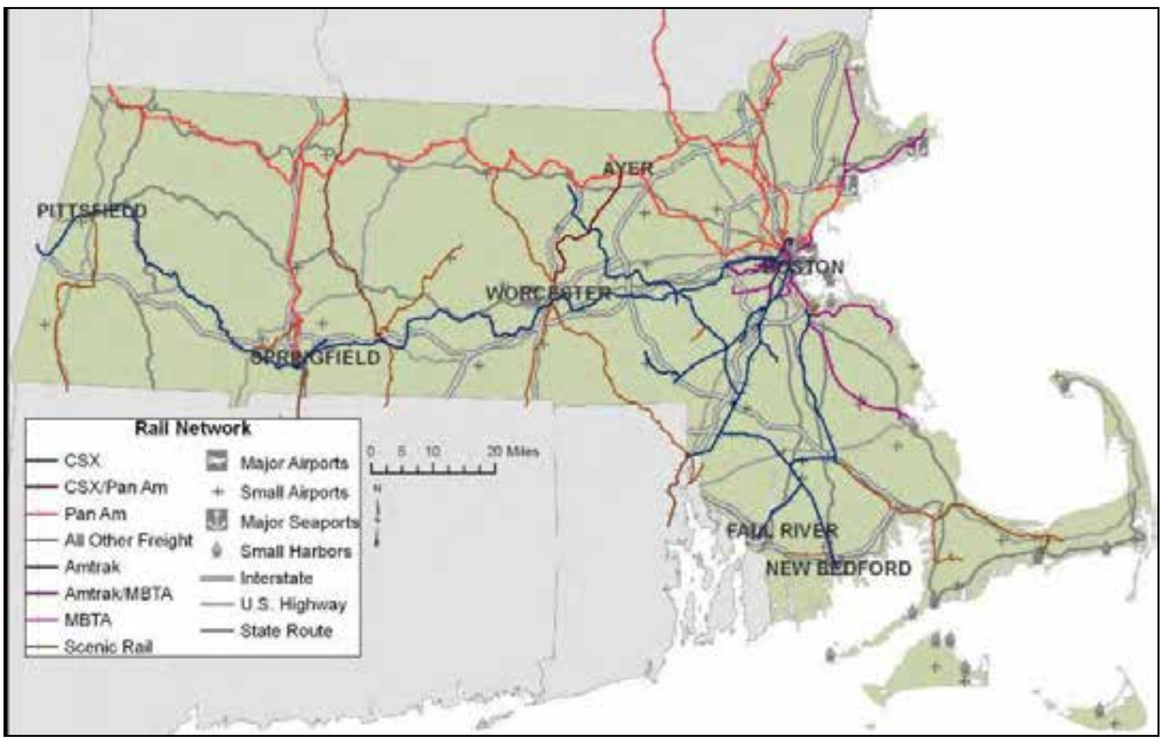
Massachusetts residents, they are a critical component of private rail business and reduce longer distance truck travel through the Commonwealth.

Massachusetts railroads also accommodate significant amounts of passenger services. Amtrak provides intercity passenger rail over portions of the freight rail network, and the MBTA commuter rail system in eastern Massachusetts. All of the MBTA owned rail lines were formerly freight lines. One of the key issues explored in this analysis is how shared use of rail infrastructure affects operations and effectiveness of passenger and freight rail services.

The rail system in Massachusetts is composed of approximately 1,139 route miles (including trackage rights) of active rail lines, supporting both passenger and freight rail services.[23] The network handles more 14.9 million carload tons and 3 million intermodal tons. The annual number of rail units – intermodal and carload – is 437,551.[24] It also transports 39.2 million commuters and 2.6 million intercity (Amtrak) passengers annually.

The Massachusetts rail network by ownership of lines is illustrated in Figure 29 below. A complete discussion of freight railroad ownership is described later in this chapter.

Figure 29: Rail Infrastructure in Massachusetts



There is a wide variation in the size of railroads within the country. To identify the relative size of the railroads the terms, Class I (one), Class II (two), Class III (three), regional, short line and terminal/switching railroad are used. The class of railroad comes from the Surface Transportation Board (STB) accounting regulations that group all rail carriers into three classes for purposes of accounting and reporting (49 CFR Part 1201 Subpart A). The class definitions

[23] Association of American Railroads 2008 Massachusetts State Profile.
[24] Global Insight TRANSEARCH 2008 Release.

are revenue-based and the threshold figures are adjusted annually for inflation using the base year of 1991. Based on the latest data available (2007):

- **Class I:** Carriers with annual carrier operating revenues of $359.6 million or more;
- **Class II:** Carriers with annual carrier operating revenues of less than $359.6 million but in excess of $28.7 million; and
- **Class III:** Carriers with annual carrier operating revenues of $28.7 million or less, and all switching and terminal companies regardless of operating revenues.

Within the railroad industry, Class II carriers are generally referred to as regional railroads and Class III carriers are referred to as short lines. This Freight Plan will refer to railroads based on the STB class definitions.

Within Massachusetts all railroads are Class II or Class III with the exception of CSX Transportation, which is a Class I railroad. To better understand the relationship of the size of railroads within Massachusetts it is helpful to first examine the national context of railroads.

2.4.1.2 Freight Rail National Context

The national rail system is fully integrated and connects shippers with both national and global markets. Major national rail developments that have impacted the Massachusetts rail system in the last 30 years include the creation of Amtrak, bankruptcy of eastern railroads, railroad deregulation, local freight rail assistance funding, the emergence of short line and regional railroads, heavy axle load railcars, and intermodal traffic. Each of these has shaped the current condition of the freight railroads.

The National Railroad Passenger Corporation (Amtrak) was created by the Rail Passenger Service Act to relieve the railroad industry of the losses they had been experiencing in the operation of intercity rail passenger service. Amtrak began service on May 1, 1971 and assumed responsibility for intercity passenger services. Amtrak principally operates on freight lines. For many years, Amtrak service experienced difficulty achieving reasonable on-time performance. Primary reasons for this situation include poor track conditions and equipment, inadequate capacity to handle both Amtrak and the freight trains of the host railroad.

In a similar fashion, the freight railroad industry was faced with three major challenges: 1) competition from cars, trucks and the emerging highway system; 2) regional economic transformations, which shifted manufacturing to different parts of the country; and 3) increasingly restrictive regulation that often stifled competition and innovation.

These three factors nearly brought the railroad industry into collapse in the 1970s. The impact to northeast states was so significant that the rail system was saved only through an unprecedented federal intervention. In 1976, the government created and financed Conrail that took over bankrupt railroads in the northeastern United States. In 1987, with payments to the US Treasury, Conrail returned to the private sector as a for-profit corporation. In 1998, Norfolk Southern Corporation and CSX Corporation acquired respective portions of Conrail through a joint stock purchase.

To address the challenges facing the freight industry and provide for increased efficient operation, the federal government instituted a substantive change deregulating all freight transportation, including rail. The Staggers Act of 1980 and the Interstate Commerce Commission Termination Act of 1995 allowed railroads to more easily adjust services and rates, enter into service contracts, merge to create larger railroads, and sell off or abandon unprofitable routes. This permitted railroads to improve their competitive position with other modes of transportation. This has been a principal element in the revitalization of the railroad industry.

The federal Local Rail Assistance Program was initiated after the passage of the Regional Rail Reorganization Act of 1973. The program was designed to provide temporary financial support for rail service continuation on lines not included in the newly created Conrail system. Massachusetts was an active participant in the program, providing funding for several branch line projects to preserve local freight services that would otherwise have been lost. After 1995, the program ceased being funded although the program is still authorized by federal law.

The short line and regional railroad industry grew and developed as regulatory relief allowed Class I railroads to rationalize their networks by selling off unprofitable routes. These new enterprising, innovative, and customer-oriented rail companies now number over 550 railroads, and have maintained and expanded local freight services.

Nationwide, the primary freight rail corridors are owned and operated by eight Class I freight railroads:

- Burlington Northern Santa Fe Railway (BNSF);
- CSX Transportation (CSXT);
- Canadian National - Grand Trunk (CN);
- Canadian Pacific Railway (CPR);
- Norfolk Southern (NS);
- Union Pacific (UP);
- Kansas City Southern Railway; and
- Soo Line Railway (CP subsidiary).

Of the eight Class I railroads noted above, only CSXT operates independently in Massachusetts, although Norfolk Southern recently entered into a partnership agreement with Pan Am Railway as a 50 percent owner of the new Pan Am Southern. Freight railroad categorization can vary, for example between the Association of American Railroads (AAR) and the Surface Transportation Board (STB), so certain statistics shown in this chapter such as numbers of railroads and track miles may also vary.

The economic freedoms provided by de-regulation has allowed the larger railroads to sell some of their light density branch lines to "short line" railroad companies – and this has been a major factor in preserving some rail services in Massachusetts. Though some of these spin-offs have failed, a great many more have lowered the cost structures of marginal, neglected, rail lines and turned them into successful operations. Short line and regional railroads now comprise approximately 60 percent of the active railroad route system in Massachusetts.[25]

Beginning in the 1970s, many coal-originating railroads increased rail car weight capacity for coal cars from 263,000 pounds to 286,000 pounds. This was the result of heavier track structures being developed that could handle these increased car loadings. In 1994, the Association of American Railroads approved the same increase in weights for covered hopper cars. The latter change has had a major market impact since these covered hoppers circulate

[25] On the national scale the Class I railroads dominate in all metrics – miles of road operated, tonnage, and revenue. The Class I railroads combined handle approximately 90 percent of all freight rail.

throughout the North American rail system hauling a variety of commodities on Class I railroads, as well as on short lines and regional railroads.

A costly effort was undertaken by the Class I railroads and some short line and regional railroads to upgrade their lines from 263,000 to 286,000 pounds to carry the heavier cars. However, track and bridge structures of some Massachusetts short line and regional railroads are still insufficient to support the 286,000 pound gross weight railcar. The issue of handling 286,000 pound cars within Massachusetts is evaluated further within the following sections.

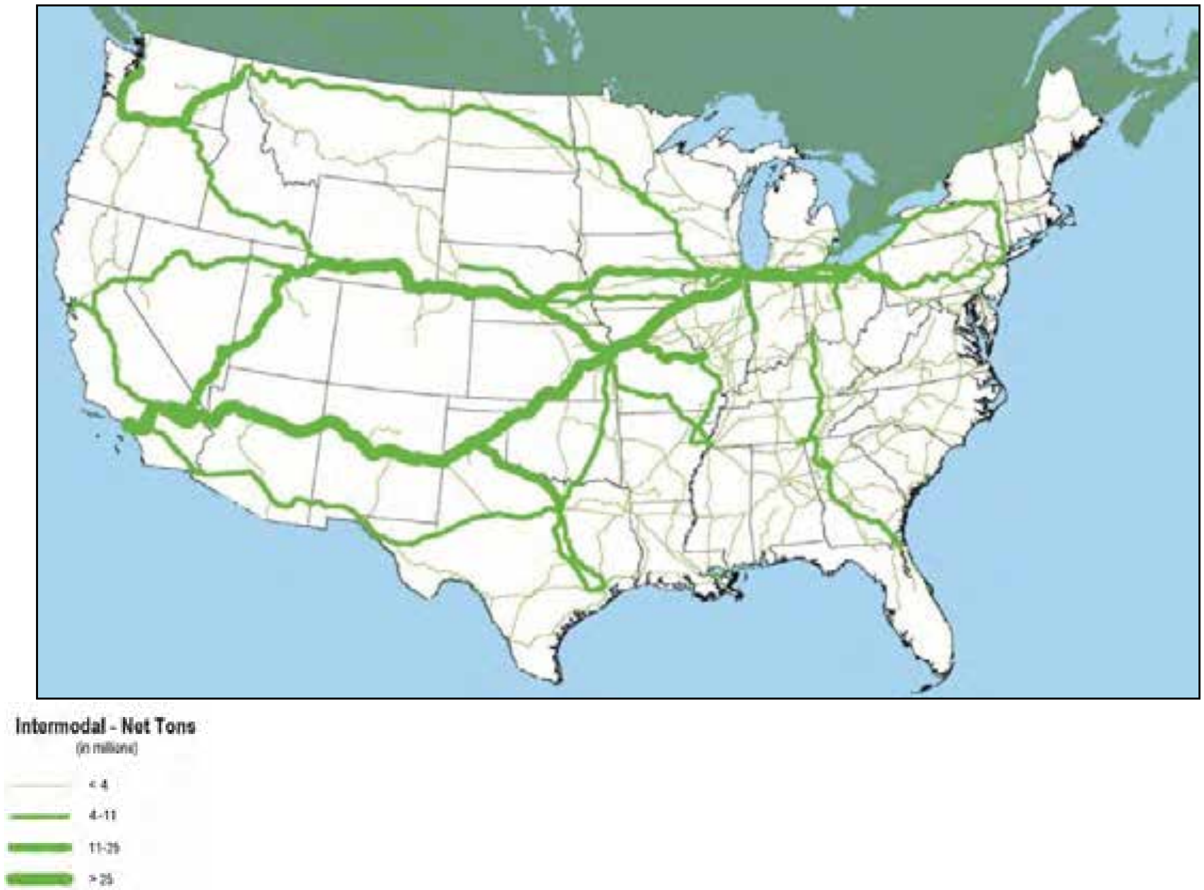
The intermodal revolution had its origins with the introduction of "piggy-back" services (trailer on flat car) in the 1950s. Today the vast majority of intermodal traffic is handled in containers, which are transferred freely between railroads, trucks, and ships. There remains some traffic handled in conventional trailer-on-flat car (TOFC) service. During the past two decades rail intermodal traffic growth has been a major contributor to the re-emergence of freight rail companies as true competitors and providers of freight service. AAR reported that annual intermodal traffic tripled between 1980 and 2002 from 3.1 million trailers and containers to 9.3 million. This growth in intermodal traffic, coupled with the projected doubling of the nation's freight volumes over the next 20 years, provides one of the strongest opportunities for the national railroad system.

2.4.1.3 Freight Rail Regional Context

The Massachusetts freight rail system is accurately characterized as a gateway to New England, carrying more than 40 percent of all freight moving through the region connecting Maine, New Hampshire, Vermont, and Rhode Island. In addition, the Commonwealth‟s rail infrastructure also supports significant commuter (MBTA) and Intercity (Amtrak) passenger rail operations serving other New England states.

The viability of Massachusetts‟ rail transportation is strongly influenced by other regional concerns. As shown in Figure 30, the New England rail market is at the fringe of the nation‟s rail activity. The map shows intermodal rail volumes by corridor, indicating that: a) freight rail volumes are most prevalent in Western, Central, and select Mid-Atlantic regions of the country; and b) overall freight rail system capacity in Massachusetts is projected to be sufficient for estimated future rail volumes (though there are local issues and bottlenecks that should be addressed).

Figure 30: Freight Rail Intermodal Volumes



Source: Federal Highway Administration, Freight Analysis Framework

2.4.1.4 Freight Railroads Operating in Massachusetts

Current freight rail movement into and out of Massachusetts is primarily movement to and from the western and central United States. While traffic along the eastern seaboard was once an important freight rail market, the majority of this traffic now moves via truck. This is partially due the freight rail infrastructure limitations that essentially require freight from the New York/New Jersey area to travel an indirect route north along the Hudson River and cross near Albany before entering Massachusetts due to passenger operations on the NEC and the lack of other rail crossings. Efforts are underway, however, to increase rail‟s share of goods movement on the I-95 corridor, especially in the more congested segments between Philadelphia, New York, and New England.

There are currently 14 freight rail companies operating in Massachusetts:

- CSX Transportation;
- Pan Am Railways (PAR);
- Pan Am Southern (PAS);
- Providence and Worcester Railroad (P&W);
- Pioneer Valley Railroad (PVRR);
- New England Central Railroad (NECR);
- Housatonic Railroad (HRRC);

- Massachusetts Central Railroad (MCER);
- Mass Coastal Railroad (MC);
- Bay Colony Railroad (BCLR);
- Fore River Transportation Company (FRVT);
- Grafton & Upton Railroad (GURR);
- Connecticut Southern Railroad (CSO); and the
- East Brookfield & Spencer Railroad (EBSR).

Norfolk Southern (NS) accesses Massachusetts, but does so through its joint venture operation with Pan Am Railways. The Pan Am Southern (PAS) commenced operations in May 2009.

2.4.2 FREIGHT RAIL SYSTEM USE

A complete assessment of rail infrastructure needs in Massachusetts requires a thorough examination of the commodities traveling within and through the Commonwealth via the rail system. This section of the report provides a detailed evaluation of current commodity flows traveling on the Commonwealth"s rail infrastructure and major freight routes to provide insight into the rail system"s performance. In addition, this section provides data and information gathered from key shippers within the Commonwealth, as well as forecasts of future freight flows and demand.

This trade flow analysis covers *all* goods movement in Massachusetts and thus captures the following four major types of trade flows for all modes:

- **Inbound:** goods originating outside of Massachusetts with a destination in Massachusetts;
- **Outbound:** goods originating in Massachusetts with a destination outside of Massachusetts;
- **Internal:** goods that have both an origin and a destination in Massachusetts; and
- **Through:** goods that have both an origin and a destination outside of Massachusetts traveling through the Commonwealth and along the state"s infrastructure.

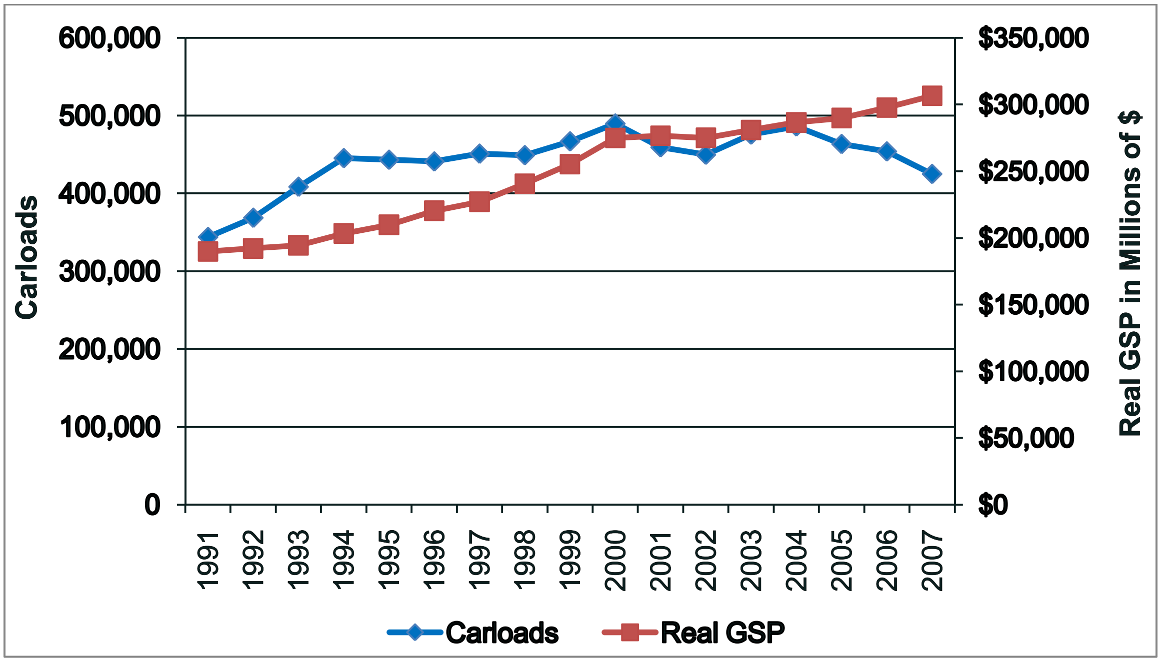
Over the past two decades, freight rail activity has seen modest growth that lags behind the overall Massachusetts economy. As shown in Figure 31, rail carloads grew by 24 percent from 1991 to 2007 while the Commonwealth"s inflation-adjusted Gross State Product (GSP) increased by 61 percent.[26] More recently, rail carloads have decreased slightly while overall economic activity continued to grow. This lagging freight rail trend is largely attributed to:

- Massachusetts economic and industry trends that continue to emphasize professional services, and a mix of high-tech and scientific industries resulting in more low-weight, high-value goods. For example, manufacturing employment in Massachusetts enjoyed an annual growth rate of 1.7 percent between 1996 and 2001, and then endured a 5.1 percent annual loss rate from 2001 – 2006. Durable goods saw a decline of 3.8 percent, paper manufacturing 6.4 percent, and plastics declined 5.3 percent. Thus, the period from 2000 onward saw the railroad"s traditional customer base shrinking while overall economic growth slowed, lowering demand for consumer goods.

[26] The historical rail carload data includes all freight shipments with an origin or destination in Massachusetts, thus excluding through-trips.

- Rail‟s competitive position in Massachusetts has eroded over time as the dominance of Class I carriers emphasized large volume rail corridors over New England, which is positioned at the fringe of the national system.
- Infrastructure constraints such as the general lack of second generation double-stack vertical clearance and the limited regional connections inhibit the ability of rail to compete with trucking for most freight shipments.

Figure 31: Growth in Massachusetts Rail Carloads and GSP



Source: American Association of Railroads and US Bureau of Economic Analysis

2.4.2.1 Statewide Commodity Flow Analysis for Rail

A complete trade flow analysis is covered in Chapter 3 of the Freight Plan with county and regional freight rail flows, not covered later in the report, highlighted here.

Rail traditionally ships heavier bulk commodities that are hauled longer distances and are generally not as time sensitive as air or truck movements, although maintaining delivery windows is still critical. The advantage of shipping freight via rail is the rail hauling capacity and relatively low costs, as it is one of the most efficient modes of transportation. Goods moved by rail account for the 6.5 percent of all freight movements in Massachusetts, including through traffic.

2.4.2.2 County and Regional Analysis of Freight Flows

This section of the trade flow analysis for rail focuses on county and regional freight flows and how freight volumes and commodities vary within the Commonwealth. The top five commodity flows by county for outbound, inbound, and internal rail shipments are presented in Table 6. Worcester County is the largest in terms of both inbound and outbound volumes.

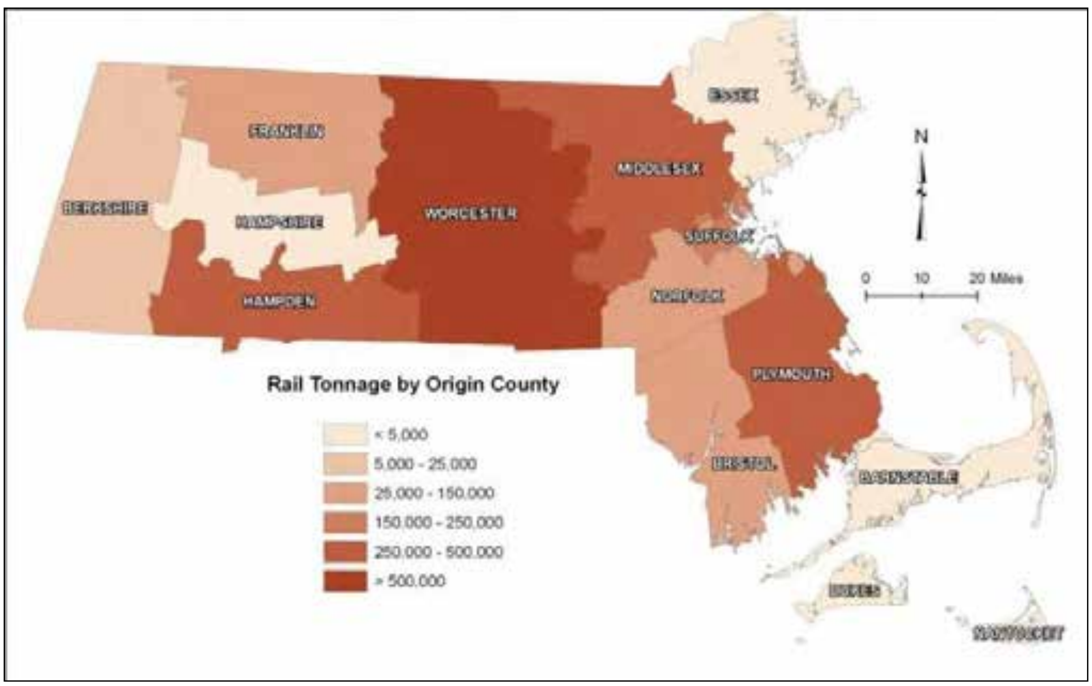
Table 6: Top Freight Movements by County and Direction, Millions of Tons

Inbound	Volume	Outbound	Volume	Internal	Volume
Worcester	1.05	Worcester	0.11	Hampshire	0.18
Middlesex	0.58	Franklin	0.09	Worcester	0.03
Hampden	0.41	Hampden	0.02	Hampden	0.03
Hampshire	0.32	Berkshire	0.01	Franklin	0
Franklin	0.03	Hampshire	-	Middlesex	0
Berkshire	-	Middlesex	-	Berkshire	-

Source: Global Insight TRANSEARCH 2008 Release

The freight tonnage moved varies both by region in the Commonwealth and direction (inbound or outbound). Figure 32 and Figure 33 reiterate that more freight tonnage terminates in Massachusetts than originates in the Commonwealth. These figures also indicate that areas of heaviest origin are Worcester, Middlesex, Hampden and Plymouth counties and areas with highest destination of freight are Middlesex, Worcester, and Hampden counties.

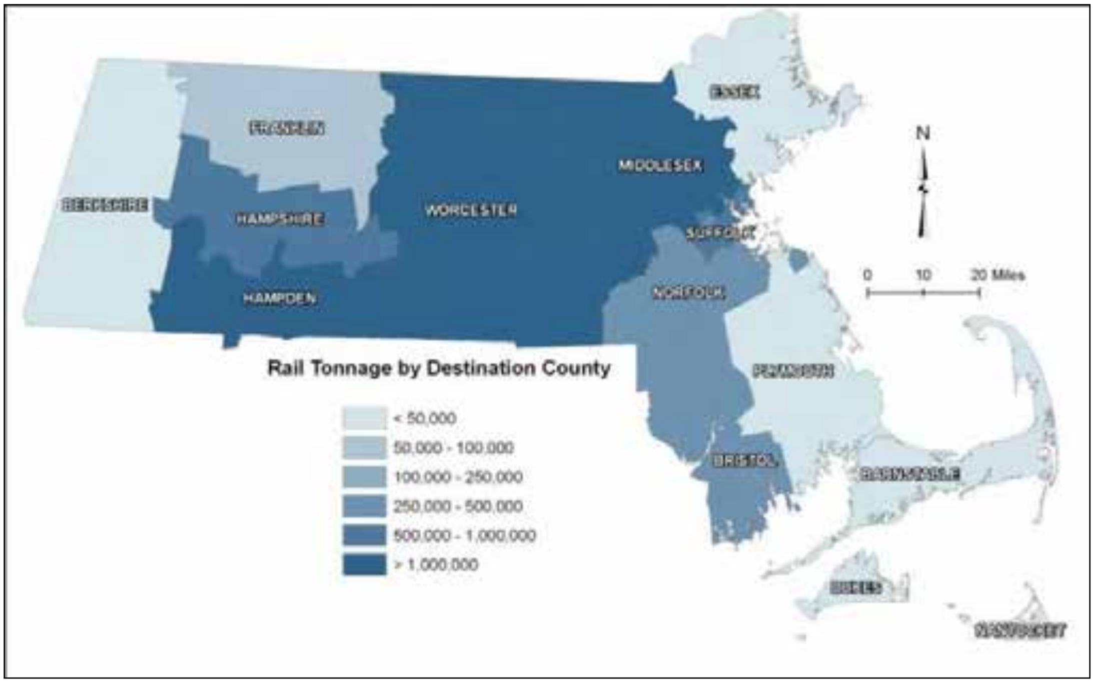
Figure 32: 2007 Rail Tonnage by Origin County



Source: Global Insight TRANSEARCH 2008 Release

The large consumer markets in the eastern part of the Commonwealth, highlighted by Middlesex County in Figure 33, demonstrate the huge volume of freight demand for inbound goods, and provide evidence as to why freight is so important to the Commonwealth.

Figure 33: 2007 Rail Tonnage by Destination County



Source: Global Insight TRANSEARCH 2008 Release

2.4.2.3 Summary of Findings from Shipper Interviews and Stakeholder Input

Part of the process for compiling the Freight Plan included public outreach to shippers and receivers who perform business in Massachusetts. In addition, regional public and stakeholder focus group meetings were conducted throughout the Commonwealth. The shippers are involved in various industries, from chemical shipment and hazardous materials transport to paper and cardboard transport, recycling to cooking oil, intermodal transfer facilities to food distribution.

The interviews focused on three main topics: operations, system conditions, and business conditions.

Operational questions were related to:

- Origin and destination;
- Types of products shipped;
- Modal usage;
- Transit times;
- Volumes; and
- Logistics.

Questions related to system conditions concerned:

- Surface routes over which they operate;
- Bottleneck or choke points;
- Changes in the conditions; and
- Indicators causing concern for future operations.

Business conditions questions focused on:

- Impact of transportation availability on the competitiveness of the business;
- Logistics factors that potentially limit growth; and
- Transportation investments that could impact operations and costs.

Findings from freight rail stakeholders provide a more comprehensive assessment than what can be provided by the data alone and these findings are incorporated into the freight rail issues and opportunities discussed below in Sections 2.4.3 and 2.4.4.

2.4.2.4 Ownership

The rail network in the northeastern US region is unusual compared to other regions of the country because of the high level of public ownership (about 40 percent in Massachusetts) and the high proportion of track that is shared by freight and passenger operations (also about 40 percent in the Commonwealth).

Over the past forty years, the Commonwealth has acquired a substantial level of ownership in rail assets, through the acquisition of hundreds of miles of trackage by the MBTA and MassDOT, in order to support its immediate and long-term transportation goals. Railroads were entirely owned by the private sector until the early 1970s, which is when the majority of these acquisitions occurred due to the major rail line bankruptcies of the Penn Central railroad and the Boston & Maine Railroad. These acquisitions included some of the commuter rail lines, in which operations continued under ownership of the public entities. Legislation and funding programs, on the federal and state level, expanded public ownership of rail lines in response to the national rail bankruptcy crisis. To address the needs of the rail network and to implement its transportation objectives the Commonwealth continues to acquire strategic rail assets and trackage agreements.

Ownership and operation of the Commonwealth"s rail network is shared between private and public entities, which, in many cases, provide passenger and freight rail operation over the same lines. MassDOT and the MBTA now own 41 percent of the transportation network. In most cases, this ownership is subject to retained freight rail operating rights or trackage rights agreements. Rail corridors owned by Amtrak, Massachusetts Water Resources Authority (MWRA), MassPort and the Massachusetts Transit Authority (MTA) represent approximately two percent of the overall rail line ownership. The remaining 59 percent of the active rail network is owned by private rail carriers. The MBTA anticipates expanding its commuter rail operations, and MassDOT continues to place a priority on preserving ROW that might be abandoned. This emphasis may result in a higher percentage of publicly owned rail lines in the years to come.

Commonwealth ownership of rail lines and corridors falls into two categories: 1) lines acquired specifically for use as commuter routes or on which commuter operations have since been developed, and 2) light density lines acquired for preserving local freight service in specific corridors.

In most instances, the acquisition does not include an obligation for the Commonwealth to continue to provide common carrier freight service. For lines with existing common carrier responsibilities, the Commonwealth has met this obligation by leasing the freight operations to an independent rail operator that is able to meet the requirements of a common carrier under the Surface Transportation Board regulations. This is important because for a rail line without a common carrier obligation to handle freight, the Commonwealth it is not mandated to operate existing service or initiate freight rail service. This allows a rail line without common carrier requirements to be rail banked for future use.

As shown in Table 7, the Massachusetts rail network is owned by thirteen entities, with the MBTA, CSX Corporation, and Pan Am Railways (PAR) / Pan Am Southern (PAS) as the largest owners within the Commonwealth.

Table 7: Active Rail Mileage by Owner

Rail Owner	Total Miles Owned Active
MBTA	378
MassDOT	152
Amtrak	10
Massachusetts Water Resource Authority (MWRA)/Fore River	3
SUBTOTAL PUBLIC:	**540**
CSX Corporation	231
Pan Am Railways/Pan Am Southern	216
Providence and Worcester Railroad	76
New England Central Railroad	53
Housatonic Railroad	38
Grafton and Upton Railroad	15
Pioneer Valley Railroad	12
Massachusetts Central Railroad	2
SUBTOTAL PRIVATE:	**643**
TOTAL:	**1,183**

Notes: 1.) "Total Miles Owned (Active)" refers to active rail corridors owned by "Rail Owner", and includes lines that are operated by "Rail Owner" and/or others; 2.) Mileage is estimated.

The following sections provide a summary of relevant operating and ownership information about the freight railroads in Massachusetts.

CSX Corporation (CSX)

CSX Corporation with its subsidiaries is a publicly traded company with its operating headquarters in Jacksonville, Florida. CSX is a large transportation services company with additional non-transportation business units. The principal railroad operating company is CSX Transportation (CSXT) and has operations in 21 states and 2 Canadian provinces. Nationally, CSXT provides freight transportation services over a network of approximately 21,000 route miles. CSX Intermodal (CSXI) is a separate business unit that provides transcontinental intermodal transportation services through a network of facilities supporting multi-modal freight movement. This report refers to all rail ownership and operations by CSX, CSXT, and CSXI as "CSX" under name of the parent corporation.

CSX is the Commonwealth"s largest private owner of rail property and only Class I freight rail operator with direct services within the Commonwealth. Within Massachusetts, CSX owns about 231 miles of active rail ROWs, and operates over a total of 410 route miles. The approximate 135 miles of the network operated but not owned by CSX within Massachusetts is operated under terms of retained freight easements or trackage rights agreements. Approximately one third of the rail lines operated by CSX under trackage rights are owned by the MBTA and MassDOT. Following the acquisition of the Fall River and New Bedford lines by the Commonwealth, the total CSX ownership has been reduced by 44 miles of ROW.

CSX"s most important rail asset within the Commonwealth is the Boston Line – a 162-mile rail corridor extending from Boston to the New York border in West Stockbridge and extending another 30 miles west to a major CSX classification yard and junction in Selkirk, NY. Selkirk is the major freight yard for CSX in the New England-New York region and is a key component of the CSX system. Key CSX rail yards and intermodal facilities are located in West Springfield, Worcester, and Westborough as presented in more detail below.

CSX also owns or operates a number of secondary lines and industrial tracks throughout Massachusetts, the majority of which are located in southeastern Massachusetts. North of Boston, CSX continues to have operating rights over the Grand Junction Branch into the Chelsea and Everett industrial areas. The MBTA operates over 35 miles of CSX-owned ROW, including the Boston Line, Framingham Secondary, and the Grand Junction. Amtrak also has operating rights over the 145 miles of CSX-owned lines, which include 140 miles on the Boston Line.

Most of the freight railroads operating in the Commonwealth interchange with CSX along the Boston Line and/or have trackage rights over the line. CSX connects to the HSRR in Pittsfield; PVRR in Westfield; and the Connecticut Southern Railroad (CSO) in West Springfield. Further east, CSX connects with the NECR and MCER at Palmer; the EBSR at East Brookfield, PW and PAR in Worcester; and the GURR at North Grafton. In southeastern Massachusetts, CSX connects to several short line local railroads, including BCRR at Medfield and New Bedford and the MC in Middleborough and the FVRR in Braintree.

East Brookfield and Spencer Railroad (EBSR)

The East Brookfield and Spencer Railroad (EBSR) is a privately held terminal operation and operates over 4 miles of trackage in East Brookfield, Massachusetts, where EBSR connects to CSX. This railroad, the newest constructed in Massachusetts, serves as the terminal operator for the auto unloading facilities located on the CSX main line in East Brookfield.

Pan Am Railways (PAR)

PAR is a privately held Class II rail carrier with operations in five New England states and New York. Its operational headquarters are located in North Billerica, Massachusetts. PAR has connections to the NECR in Montague and Northfield, and the PW in Gardner and Worcester. PAR exchanges traffic with CSX in Worcester and Ayer. PAR also connects with PAS at Ayer.

The PAR/PAS owns approximately 216 miles of railroad ROW in Massachusetts, operating on over 373 miles in the Commonwealth. PAR"s rail ownership and operations are carried out by its subsidiaries, the Boston and Maine Corporation (B&M), which is the property owner, and Springfield Terminal Railway (ST), which operates the railroad. PAR operates more than 150 miles of MBTA ROW and provides train dispatching for the perimeter[27] lines of the MBTA commuter rail network.

[27] Perimeter lines were those routes acquired by the MBTA in 1976 that did not initially host passenger operations, and were to be maintained and operated by the B&M. When MTBA added service to their routes the "Jointly Used Line" provisions would apply.

The PAR/PAS Freight Main Line is the railroad"s most important line within the Commonwealth. It runs 475 miles from northern Maine to eastern New York. The Freight Main constitutes nearly 160 miles of the 216 miles in Massachusetts. Nearly 34 miles of the Freight Main Line is owned by the MBTA.

Pan Am Southern (PAS)

On May 15, 2008, Norfolk Southern and PAR announced the formation of a joint venture called Pan Am Southern. PAS has identified plans to conduct freight rail operations across parts of western and central Massachusetts to connections to Mechanicville, NY. The new entity was approved by the US Surface Transportation Board early in 2009. PAS began operations in the spring of 2009. This joint venture is anticipated to enhance rail competition in New England with the influence of another Class I freight railroad on railroad operations in the Commonwealth.

An important element of the joint venture is the rehabilitation of the PAS Main Line between Ayer and Mechanicville, NY. The partnership includes rehabilitation of 138 miles of track, replacement ties, and adding just over 35 miles of new rail. The $47.5 million effort that began in 2009, and expected to be completed in 2010, is one of the largest new private investments in the Commonwealth"s rail system in decades. A new intermodal and auto terminal will be constructed in Mechanicville, NY, and expansions and improvements will be made to the auto and intermodal facilities in Ayer. This joint venture is operated by employees of the Springfield Terminal Railway, a wholly owned subsidiary of PAR. The investments in the Patriot Corridor have increased capacity and reliability to Ayer, Massachusetts, opening up future opportunities and connectivity throughout the region.

Throughout this document, the term PAR is used as reference to Pan Am Railways, unless the segment being discussed is jointly owned by PAR and NS, in which case, PAS will be used.

Providence and Worcester Railroad (PW)

The Providence and Worcester Railroad is a publicly traded Class II regional freight railroad operating in Massachusetts, Rhode Island, Connecticut, and New York with headquarters in Worcester, Massachusetts. The PW's rail system extends over approximately 516 miles of track regionally, of which it owns approximately 163 miles. The company has the right to use the remaining 353 miles pursuant to perpetual easements and long-term trackage rights agreements.

The PW owns and operates about 95 miles of rail ROW in the Commonwealth, including lines emanating from Worcester to Gardner, and to the Massachusetts line on routes to Providence, Rhode Island and Norwich, Connecticut. The PW also has overhead[28] trackage rights over various segments of MBTA, MassDOT and CSX-owned lines in southeastern Massachusetts to access and serve its Newport Secondary Track in Rhode Island. The PW serves two major intermodal terminals in Worcester operated by Intransit Container Inc. The PW also connects with PAS in Gardner and with both CSX and PAR in Worcester.

Bay Colony Railroad (BCLR)

The Bay Colony Railroad is a privately held, Class III railroad with headquarters in Braintree, Massachusetts. BCLR has connections to CSX in Medfield and New Bedford, Massachusetts.

[28] Overhead trackage rights refer to a right to pass over the route, but does not allow service to on line industries.

BCLR conducts freight rail operations over MBTA-owned ROWs between Newton Upper Falls and Needham Junction; Needham Junction and Medfield; Medfield and Millis; and on the Fall River Branch (a.k.a. Watuppa Branch) in southeastern Massachusetts.

Connecticut Southern Railroad (CSO)

The Connecticut Southern Railroad is part of the RailAmerica family of short line railroads (see NECR). It is a Class III railroad with operating headquarters in East Hartford, Connecticut, which operates about 77 miles of track in Connecticut and Massachusetts. The CSO interchanges with CSX at West Springfield, Massachusetts, and New Haven, Connecticut, the P&W in Hartford and the Central New England Railroad in Hartford, and East Windsor. The CSO does not serve any customers within Massachusetts, but operates over the Amtrak-owned Springfield Line between North Haven and Springfield and the CSX Boston Line to interchange with CSX in West Springfield. All of CSO‟s freight customers are located in Connecticut. The CSO is the sole freight rail provider in central Connecticut.

Fore River Transportation Company (FRVT)

This Class III railroad is owned by its largest customer, Twin Rivers Technology LLC, a manufacturer of industrial inorganic chemicals (rendering of glycerin, fatty acids). The Quincy, Massachusetts, plant has access to worldwide ocean shipping lanes through its own deepwater port facilities and storage terminal.

Headquartered in Quincy, the FRVT operates for the Massachusetts Water Resource Authority (MWRA)‟s three mile Fore River Railroad line. FRVT operates over MBTA-owned tracks on CSX trackage rights between East Braintree and South Braintree where it interchanges traffic with CSX. MWRA uses a private contractor, the New England Fertilizer Company (NEFCO) to haul sludge by barge from it Deer Island treatment plant to its Fore River Staging Area (FRSA) in Quincy. NEFCO operates sludge dewatering and drying facilities at FRSA and utilizes the FRVT railroad to transport solid sewage waste (sludge) from its sewage treatment plant to its residuals processing facility (NEFCO) and then ships out processed material by rail.

Grafton and Upton Railroad (GU)

The Grafton and Upton Railroad is a privately held Class III railroad with headquarters in Marlborough, Massachusetts. The GU owns trackage running from an interchange with CSX in North Grafton to a second interchange with CSX in Milford, a distance of approximately 15 miles. The active customers on the Line are clustered at the north end of the corridor in North Grafton but the railroad has an active program to develop business along its entire route.

Housatonic Railroad (HRRC)

The Housatonic Railroad is a privately held, Class III railroad with operations in Massachusetts, Connecticut and New York. Its operating headquarters are located in Canaan, Connecticut. The HRRC owns and operates about 38 miles of ROW in the Commonwealth, primarily along its Berkshire Line (formerly the Canaan Secondary) in western Massachusetts. HRRC also operates about 2.5 miles of ROW along the southern portion of the North Adams Secondary. The HRRC and MassDOT have an operating agreement with the Berkshire Scenic railway museum for tourist operations.

Massachusetts Central Railroad (MCER)

The Massachusetts Central Railroad is a privately held Class III railroad. The MCER operates freight rail service over the 25-mile Ware River Secondary in central Massachusetts, of which

23.5 miles is owned by MassDOT. MCER operates under a license and operating agreement with MassDOT. Company headquarters, yard, and intermodal facilities are located in Palmer, Massachusetts, where it receives and ships trailers via CN, CSX, CPRS or NCER. The MCER interchanges with CSX and NECR in Palmer and has a plastics transloading operation in Barre, Massachusetts.

New England Central Railroad (NECR)

The New England Central Railroad is part of the RailAmerica family of short line and regional railroads. RailAmerica, owned by the Fortress Group, owns 42 railroads operating approximately 7,800 miles in the United States and Canada. NECR headquarters are located at St. Albans, Vermont.

The NECR is a Class III railroad that operates 53 miles of ROW between Monson and Northfield, Massachusetts, which is NECR"s Main Line. Its major Massachusetts facility is located at Palmer, where it interchanges with CSX. NECR also interchanges with PAR in Northfield and Montague. NECR provides a major north-south rail corridor in the region, linking Canada with Connecticut.

Pioneer Valley Railroad (PVRR)

The Pioneer Valley Railroad is one of several railroads owned by the Westfield based Pinsly Railroads holding company, a privately held firm. PVRR interchanges with CSX in Westfield, Massachusetts, and is expected to soon reopen its connection at Easthampton with PAS.

PVRR is a Class III railroad that owns and operates about 17 miles of rail ROW in and around the Westfield and Holyoke areas of western Massachusetts. PVRR also provides transloading, warehousing, and trucking services through its subsidiary firm, Railway Distribution Services (RDS) of Massachusetts.

Massachusetts Coastal Railroad (MC)

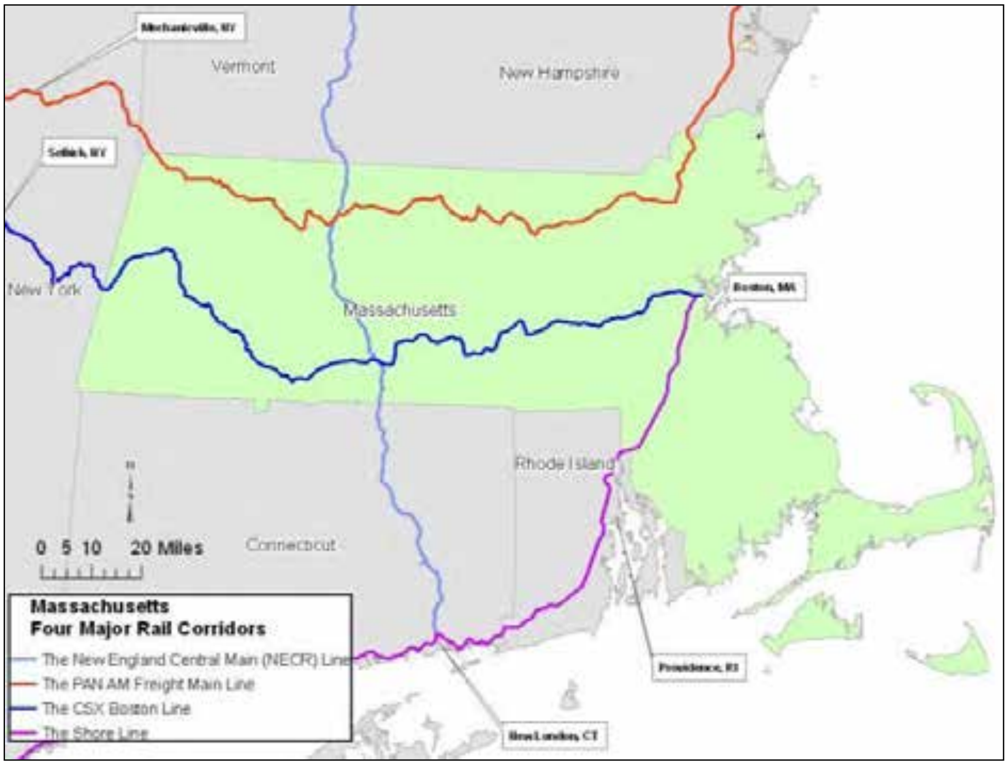
The Massachusetts Coastal Railroad is a privately held Class III railroad and is part of Cape Rail, Inc., which also operates the Cape Cod Tourist operation. The MC has headquarters in Hyannis, Massachusetts (Barnstable). MC connects to CSX in Middleborough, New Bedford, and Taunton. MC operates freight rail service over about 55 miles of MassDOT-owned ROW in southeastern Massachusetts and Cape Cod under a lease and operating agreement with MassDOT. Massachusetts Coastal Railroad recently acquired the freight operating rights to the Fall River and New Bedford Secondaries from CSX.

2.4.2.5 Principal Rail Lines in the Commonwealth

Based on rail volumes and interstate connections, there are four major rail corridors into and out of Massachusetts. Freight rail connections with the North American rail network are primarily accomplished by means of three corridors: the Boston Line, the PAR Freight Main Line, and the NECR Main Line. The two primary east-west routes that connect New England with the national rail system at Albany, New York, are Boston Line and the PAS/PAR Freight Main Line. The NECR Line crosses the Commonwealth from north to south connecting northern Vermont and Canada with southern New England, terminating at New London, Connecticut. While other routes can be used to connect to the general rail network, the three routes cited are the primary and most direct routes. The fourth line, Northeast Corridor, is the primary passenger route between Boston and Washington, D.C.

Massachusetts"s four major rail corridors are shown in Figure 34. These corridors provide nationwide and regional connectivity for Massachusetts rail passenger and freight.

Figure 34: Major Rail Corridors in Massachusetts



The Boston Line

The CSX Boston Line is the freight rail corridor that handles the largest amount of freight rail traffic moving into and out of Massachusetts and New England. The Boston Line, carrying more than 10 million tons annually over much of the route, runs between Boston and Selkirk, New York (outside of Albany). It generally parallels the Mass Pike with 162 miles of the Boston Line in Massachusetts, between Richmond and Boston. Much of the merchandise traffic destined for CSX yards and customers, PAR‟s northern New England customers, or many of the New England short line railroads enters or leaves New England via this route.

All intermodal traffic destined for West Springfield, Worcester and Beacon Park/Allston traverses this corridor. This rail corridor also handles finished automobiles into New England.

The MBTA operates commuter rail service between Boston and Worcester and Amtrak uses the route for its “Lake Shore” service to Chicago. The Amtrak “Vermonter” service currently uses the Boston Line between Springfield and Palmer until the completion of the Knowledge Corridor Project. Additionally, Amtrak trains on the Inland Route use this line between Boston and Springfield. The west end of this corridor, which transverses the Berkshire Mountains between Springfield and Albany, has many curves and significant grades on both sides of the mountains. Nonetheless, it provides the primary freight rail route to the south and west. As mentioned elsewhere in the Plan, this rail corridor is slated for vertical clearance upgrades to allow for complete double-stack clearance from the New York border to Westborough.

PAR/PAS Freight Main Line

The PAR/PAS Freight Main Line is a corridor linking northern Maine, New Hampshire, and northern Massachusetts to connections with New York State. The Freight Main Line serves up to 5 million tons annual of freight on the line. It uses existing rail line, between eastern Massachusetts and Mechanicville and Rotterdam, New York, near Albany. The route has 160 miles of the PAR Freight Main Line in Massachusetts. It is an important rail link for the paper and lumber industries located in northern New England and the Canadian Maritimes, and supports intermodal traffic destined for Ayer, Massachusetts, as well as general merchandise traffic for eastern Massachusetts. The PAR/PAS split on the Freight Main Line is in Ayer with the route west in the PAS joint venture.

This route tends to parallel the Route 2 corridor and connects Boston, Fitchburg, Ayer, Greenfield, and North Adams, Massachusetts with the Albany, NY, area. The PAR Freight Main Line has fewer and less severe grades than the CSX-owned Boston Main Line, in part because it travels through (rather than over) the Berkshire Mountains via the nearly 6-mile long Hoosac Tunnel. The East Deerfield Yard is a major facility located on the route, and is partially owned by the Commonwealth (MassDOT) but subject to permanent easement for railroad uses by PAS.

MBTA commuter rail service operates over the Freight Main Line between Fitchburg and Ayer and into Boston via the Fitchburg Main Line. This route includes the new PAS territory. The route will receive significant investment in track, signals and facilities under the Patriot Corridor program jointly funded and operated PAR and NS. Planned improvements include upgrading the corridor to handle 286,000 pound rail cars to Ayer from the west as well as enhanced automotive handling capacity.

NECR Main Line

The NECR Main Line runs in a north-south direction, providing a direct link between southern New England at New London, Connecticut and to a connection with the Canadian National, at East Alberg, Vermont. NECR connects with the Vermont Railway (VTR) at Burlington, Vermont, PAS at Millers Falls, Massachusetts, CSX and MCER at Palmer Massachusetts, and the PW at New London, Connecticut, and 53 miles of NECR Main Line are in Massachusetts. Due to the large number of connections with other short lines, the NECR Line provides an important role in providing competitive access to the national rail system. The Line carries a variety of freight commodities, including lumber products shipped from Canada to the Port of New London. Average annual freight rail tonnage in this corridor is approximately 1.3 million tons. The NECR accommodates the Amtrak “Vermonter” Service between Palmer, Massachusetts and St. Albans, Vermont until completion of the Knowledge Corridor Project.

2.4.3 FREIGHT RAIL FACILITIES AND YARDS

In addition to the rail lines and corridors, rail yards and intermodal terminals are an essential component of the Commonwealth‟s freight rail infrastructure. They provide connections between rail lines and operators as well as critical intermodal integration between rail and trucks.

The freight facilities, yards and terminals in Massachusetts vary significantly in terms of size and function. They include intermodal facilities, automotive facilities, large to small rail switching yards, and rail-to-truck distribution centers.

Definitions:

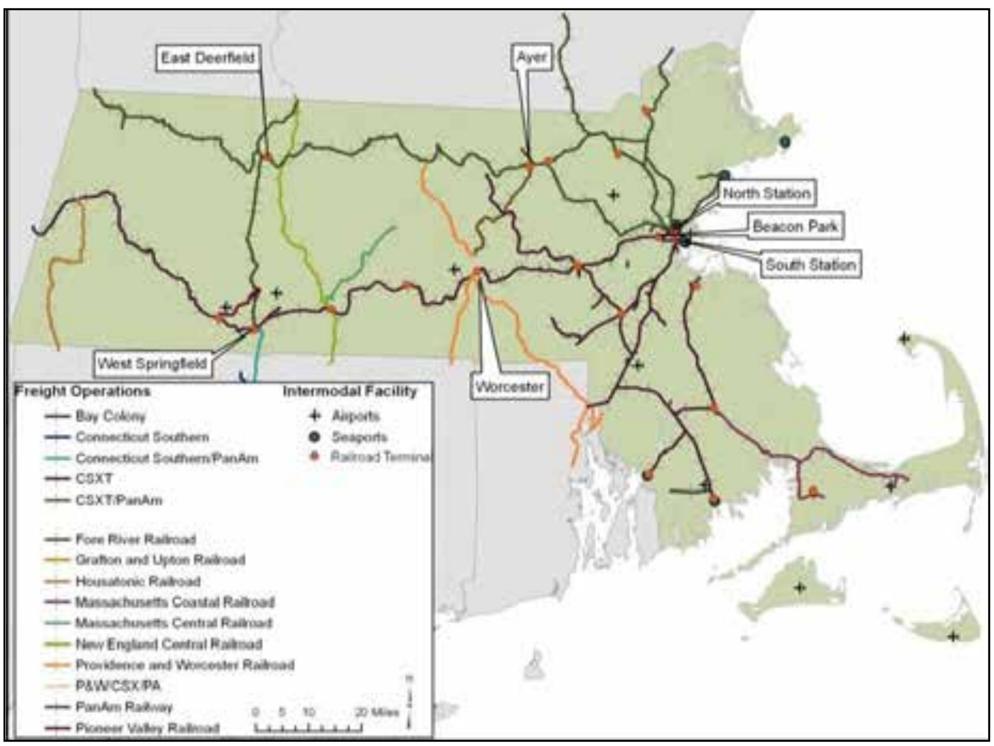
For the purpose of this report, the terms **freight rail facilities and/or yards and terminals** are defined as locations where freight routes connect and/or terminate.

For the purpose of this report, **intermodal freight** is the term that describes shipments that involve more than one mode of transportation from origin to destination. Intermodal shipments may include rail to truck, truck to rail, ship to truck or rail and truck to air carrier. Some intermodal shipments of products also move into the region via pipeline and are then transferred to truck or rail for final delivery. Generally these commodities are energy related (gases, fuels). **Intermodal facilities** are defined as specifically designed yards or designated segment of yards, where freight is interchanged or transferred to another mode. The focus in this analysis is on facilities with direct connections to rail.

2.4.3.1 Freight Rail Yards

The major freight rail yards in Massachusetts are illustrated in Figure 35. The function, size and importance of these facilities, some in place for more than 100 years, have changed over the past half century as both land use patterns and transportation systems have evolved in both the Commonwealth and the region. A current example of this change is the proposed PAS automotive and intermodal facility to be built on the site of a former rail car classification yard in Mechanicville, New York.

Figure 35: Massachusetts Major Rail Yards and Terminals



Related to the changes in freight yards and terminals are the locations of major freight generators, such as the distribution centers that have located around both the Route 128 and I-495 circumferential highways, and with considerable density in southeastern Massachusetts. Distribution facilities are also located and under development in central and western Massachusetts and eastern Connecticut. These large-scale distribution centers receive bulk volumes by rail or truck, or by marine containers that arrive by either rail or truck. The freight is then transloaded for regional and local delivery to wholesalers or retail outlets. Distribution centers and intermodal facilities are highly interdependent.

Most yard infrastructure and connections between various railroads in Massachusetts have been reduced in size or eliminated over the past half century in response to ever-declining boxcar traffic volumes. Over time, formerly critical inter-railroad interchanges have been de-emphasized, while others have been improved and developed. The force behind these decisions is the rail customer. In general, the rail customer provides the market forces and the railroad follows with their best-case response to market demand. As demonstrated, the shifting emphasis of the economy away from large, bulk shippers of natural and manufactured products has limited the growth of rail customers. In some cases, this has dramatically reduced the number of businesses with shipping needs consistent with freight rail service.

2.4.3.2 Principal Intermodal Container and Automotive Terminals

Freight intermodal rail operations are located across the Commonwealth. They consist of a combination of large facilities and smaller facilities.

Intermodal Container/Trailer Terminals

Intermodal container/trailer terminals are locations that unload and load containers or truck trailers from rail cars designed to handle these shipments (See Chapter 4 for further discussion). Containers are then placed on a specially designed truck chassis for movement. Truck trailers are moved by direct connection to a truck.

Intermodal yards are typically located in areas that have a market for delivery/pickup of products that are within a distance of approximately 250 miles. This is to facilitate the movement from the intermodal yard to the origin/destination and return within a single shift for at truck driver.

In Massachusetts the rail intermodal container/trailer terminals are:

- Beacon Park in Boston (CSX);
- Worcester (CSX);
- Worcester (PW);
- West Springfield (CSX); and
- Ayer (PAS).

Intermodal Automotive Terminals

The rail terminals for new automotive unloading in or near Massachusetts are:

- CSX automobile facility centralized in East Brookfield/Spencer, Massachusetts, along the Boston Line;
- New and existing PAS automobile facility in Ayer; and
- New automobile facility in Davisville, RI, served by the PW.

Future of Intermodal Container and Automotive Terminals

Intermodal container and automotive terminals is a major and expanding rail service in Massachusetts. Substantial changes in intermodal terminals have recently occurred and additional changed are anticipated to occur in the near future. Principal changes include the following.

PAS has completed a second automotive unloading facility at Ayer and enhanced the intermodal container/trailer facility in Ayer. CSX is in the process of reconfiguring their intermodal container/trailer operations in the Commonwealth, centering them on Worcester and West Springfield. CSX is in the process of review of plans with local and region officials. Their identified plan is to relocate their existing operation in Boston to these other locations. At West Springfield, changes to highway connections at the yard that will enhance access to the facility are under design.

2.4.3.3 Transload Facilities

Transloading refers to the transfer of a shipment from one mode of transportation to another. The term is used most commonly to describe the transportation of non-containerized freight by more than one mode. An example of transloading is the transfer of bulk material from a railcar to a truck. Such transfers may occur in railroad yards, port facilities, or public delivery tracks. This term differs from the general application of the term “intermodal” that is applied more specifically to containers or trailers on more than one mode.

Transloading may be accomplished at any facility where modes are able to connect. The freight yards and terminals in Massachusetts vary significantly in size and function. The key rail facilities with transloading capabilities include:

- Beacon Park Yard Boston (CSX);
- Westborough Yard (CSX)
- Worcester (CSX and PW)
- Ayer/Devens (PAR); and
- Westfield (PVRR).

Included in this category are chemicals and fuel transfer facilities. Additionally, bulk material such as sand and gravel, roadway salt and lumber products are included in transload operations. Material such as this requires a significant area for temporary storage of material before final delivery. Other material, such as plastic pellets used in manufacturing, can be transferred directly from rail car to truck for final delivery. Because of the wide variety in the nature of transloading operations, rail transloading facilities will vary in size and level of activity. A critical consideration for transload operations is the availability of land served by rail. Thus, the issues related to land use are of significant interest to transload based rail operators and users.

2.4.3.4 Seaports

In Massachusetts, five seaports are rail accessible. They include:

- South Boston Industrial Park (inactive rail);
- Fall River;
- New Bedford;
- Quincy; and
- Everett.

There are also port freight facilities outside of Massachusetts that are critical to effective goods movement within the Commonwealth. To the north, the ports of Halifax, Portland, Montreal, and Portsmouth provide essential marine and/or rail services to businesses in Massachusetts. The largest port on the East Coast is the Port Authority of New York/New Jersey, which helps meet the import and export needs of the entire region, including all of Massachusetts. The Port of Albany and the rail reload centers in the Albany Capital District also serve Massachusetts shippers and consumers.

2.4.4 FREIGHT RAIL ISSUES

This section describes freight rail issues of relevance to the Commonwealth of Massachusetts. It builds on the stakeholder interview findings from above to focus on the following issues:

- Energy and the environment;
- Funding;
- Infrastructure issues;
- Main line capacity;
- Yard infrastructure and capacity;
- Shared use rail corridors;
- Vertical clearances;
- Weight on rail; and
- Safety and security.

2.4.4.1 Energy and the Environment

The transportation sector is a major source of emissions and contributor to global climate change. Potential carbon taxes and associated regulatory changes are likely to impact industrial and energy production and also affect the freight industry. For example, coal is the largest source of energy production in the US and also one of the largest commodities in terms of rail trips throughout the country. Conversions to alternative energy sources could re-distribute and/or reduce freight transportation demand for energy-related goods.

Environmental considerations could impact modal shares as modes vary in terms of energy efficiency. Rail is more environmentally friendly for longer hauls than truck based on energy efficiency and emissions. CSX is now heavily promoting how freight rail (compared to truck) uses less fuel and produces fewer emissions per ton mile. They note that their trains can transport one ton 423 miles on a single gallon of gas, and that using rail instead of truck results in 6.5 million fewer CO_2 emissions.[29] In addition, conservation initiatives and technologies aimed at reducing fuel consumption, green house gases, and limiting climate change will impact transportation costs.

[29] http://www.csx.com/?fuseaction=about.environment

The energy efficiencies available through the better utilization of railroads in Massachusetts are potentially significant. Intercity passenger rail service uses 20 percent less energy per passenger mile traveled than automobiles and 15 percent less than airline travel.[30]

For long haul distances, freight rail transportation is more energy efficient than trucking or shipping by air. Based on data from AASHTO, moving more freight by rail would do the following:[31]

- If one percent of long-haul freight that currently moves by truck were moved by rail instead, fuel savings would be approximately 111 million gallons per year and annual greenhouse gas emissions would fall by 1.2 million tons.
- A single intermodal train can take up to 280 trucks off the highways. Depending on length and cargo, other trains can take up to 500 trucks off our highways.
- Railroads enhance mobility and reduce the costs of maintaining existing roads and the pressure to build costly new roads. Railroads are curbing fuel consumption through the use of technology, training of personnel and changes in operating practices.

2.4.4.2 Funding for Freight Rail

Privately-owned freight rail service providers generally finance rail improvements through current cash flow based on expectations of future demand. The private ownership structure of freight railroads, combined with the fact that there are restrictions in using public funds for privately-owned infrastructure means that freight rail projects have not traditionally been funded by public resources.[32] As a result, alternative sources of funding must be, and have been, pursued.

Some opportunities for public-private partnerships do exist, however, and publicly-funded infrastructure improvements for passenger rail service do result in benefits to freight rail providers as well. A complete discussion of state and federal funding sources for rail investment is provided in the Funding and Financing section of the report (Chapter 5).

2.4.4.3 Freight Rail Infrastructure Constraints

As presented in the following sections, these issues principally relate to yard infrastructure and connectivity, shared use, vertical clearances, and allowed weight on rail.

In addition, the lack of state funding for infrastructure improvements and lengthy permitting and environmental impact study periods create inefficiencies and restrictions for building or adding capacity to distribution centers. There are underutilized assets that could be considered to increase freight opportunities.

Main Line Capacity Constraints

In the evaluation of the freight rail operations with in the Commonwealth the capacity of the rail system was considered. An important aspect of the rail capacity is the ability to move trains along a give rail route between rail yards and interchange points with other rail operators. The principal considerations for capacity to move trains along routes is the number of main tracks, passing tracks for meeting or overtaking of trains, and the speed allowed along the tracks.

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[30] United States Department of Energy, "Transportation Energy Data Book", Edition 27, 2007-2008 Table 2.12.
[31] Association of American Railroads (AAR), "Freight Railroads & Greenhouse Gas Emissions", July 2007.
[32] Freight Transportation: Strategies Needed to Address Planning and Financing Limitations, prepared by the General Accounting Office (GAO), December 2003.

In discussions with rail operators there where only a few locations that were identified as having insufficient main line capacity to handle existing and anticipated future freight and/or passenger needs. When considering main line capacity, the consideration is to be able to move the desired number of trains at the time of day when they would like to move. In some cases, physical capacity restrictions can be handled by rescheduling movements to occur at different times of the day. This is generally associated rescheduling of freight operations, but can be done with passenger operations. For passenger service, this might be best accommodated by intercity type of service as it might be less sensitive to meeting the demands of a commuter based service.

The other major type of main line capacity restriction occurs when track conditions do not allow a sufficiently high speed of operation to transit the route and serve the demand. This is typically associated with freight operations, but can also apply to passenger operations that utilize shared corridors, including non- commuter types of passenger service such as intercity and tourist based operations.

Major main line capacity constraints in Massachusetts not related to vertical clearance or rail car weight capacity include:

- **Andover Single Track –** In the Andover area used for freight, commuter and Amtrak Downeaster operations there is single mainline track. The MBTA is using $17.4 million in ARRA funds to install double-tracking and improve the train control systems between Lawrence and Andover. This project will improve reliability and on-time performance for the Haverhill commuter rail line, Amtrak‟s Downeaster trains as well as freight rail operations.
- **Holyoke Interchange –** In Holyoke there is a discontinued interchange connection between PVRR and PAS. This interchange will be restored in the near future to provide a second carrier connection for PVRR to facilitate increasing options for service.
- **Mansfield Freight Connections –** Freight rail connections between Framingham and southeastern Massachusetts freight lines must cross the Northeast Corridor for freight connections at Mansfield. This limits freight rail operations. A related issue is the limit of 263,000 pound for rail cars on the Northeast Corridor.
- **Beacon Park to South Boston –** Recent increase in passenger service and reconfiguration of tracks in the South Station area for passenger service have created restricted assess to South Boston freight facilities via MassPort track 61.

Yard Infrastructure and Connectivity

The constraints associated with yard infrastructure result in choke points or bottlenecks that affect overall system performance. Improvements in travel time associated with rehabilitation of mainline tracks can easily be offset by efficiencies in handling of rail cars in yards or interchange points between railroads. Such constrained inter-railroad connections impair overall system capacity.

By example, connectivity between the PW and CSX at Worcester is restricted due to the layout of each railroad‟s yard and interchange tracks that can lead to congestion in the area of Worcester Union Station. This situation may adversely affect Amtrak, MBTA as well as PW and CSX operations. Both railroads have cooperated effectively over the years to minimize any main line disruptions and to provide a high level of service to freight customers in the region. However, this situation may make it difficult to expand service that is based on interchange between the railroads.

From a regional perspective, a significant restriction cited for freight rail included inefficiencies in yards in Selkirk and Rotterdam Junction, New York. The rail yards are reported to have need for additional capacity to handle the volume of trains to and from the yards. To respond, additional tracks are being considered for Selkirk Yard.

Another key driver of freight rail efficiency is "right-sized" yards. Over the past 50 years many of the rail yards in Massachusetts have been adapted to meet new or expanded roles, but in many other cases have been reduced or closed entirely as traffic moved to other transportation providers. Market forces drive these adjustments and with freight demand increasing, many of these smaller yards and facilities are unable to keep up. This results in less than acceptable service that limits use of rail by shippers.

The challenge in Massachusetts for both Commonwealth government and the businesses that rely on freight rail service is that the railroad infrastructure has been downsized, real estate has been sold off, and new and incompatible land uses have developed around former rail yards.

The identified yard capacity restraints include:

- **South Station –** Passenger station tracks and approach track need to be expanded to support major planned expansions of service such as South Coast Rail, Inland Route, and Acela trips.
- **North Station –** Passenger station tracks and approach track need to be expanded to support any additional or significant expansion of service.
- **Worcester Yard –** CSX intermodal facilities have reached capacity. CSX is planning for expansion of the facilities.
- **Ayer –** PAS intermodal facilities are limited due to available land and the current configuration of the facility.
- **Freight Main Line –** The PAR yards along the freight mainline in the area of Lowell and Lawrence have been reduced or removed in response to traffic demands.

Shared Use

One of the important considerations for the rail network of the Commonwealth is the extent to which the network is shared by passenger and freight rail operators (Figure 36). These shared corridors within the Commonwealth generally function well. Shared use has the potential to improve the ratio of benefits to costs of infrastructure investments, yet complex issues often arise regarding scheduling, cost sharing and liability.

Within the Commonwealth, there are plans to increase the use of shared corridors. These include the relocation of the Amtrak Vermonter to the PAS Conn River line between Springfield and East Northfield and the extension of MBTA commuter service to Wachusett on the PAR/PAS Freight Main Line. This is the result of a cooperative assessment of passenger and freight needs on shared corridors.

It is important to note that although the cited use of shared corridors represents a mostly positive experience, the ability to add or expand passenger service, or even freight movements, on a given rail line cannot be taken for granted. The analysis of each passenger service must be undertaken in concert with the freight line owner or, in the case of state-owned lines, the freight operators. The passenger and freight changes associated with the CSX line acquisitions by the Commonwealth is an excellent example of the complete analysis needed to find the solutions to changes or improvements that are needed to support the expansion of shared use corridors.

Figure 36: Freight Operations with Shared Passenger Use

Vertical Clearances

Vertical clearance is the envelope of space available between the top of rail and the lowest point of an overhead structure of a rail line. For a rail line route, vertical clearance is defined as the clearance of the most restrictive structure on that particular route.

Principal intermodal shipments to the Commonwealth and region are related to container/trailer movements via rail cars. The purpose of these types of shipments is to allow a container/trailer of freight to move from origin to destination without opening the container/trailer for re-handling or repackaging of the freight cargo. The genesis of this type of rail traffic was the use of rail flat cars to load truck trailers for shipment. This type of service is known as “trailers on flat cars” with “TOFC” as the abbreviation. Initial means of loading of rail cars was to place a ramp at the end of a string of flat cars and the trailers were driven onto the cars. Most handling of trailers is now done with the use of a large lifting vehicle that moves along the string of cars to place and remove the trailers.

Over the past two decades, there has been a rapid raise in the development and use of containers. The containers can be stacked for storage and transport. Individual containers can be placed on a specifically designed truck trailer chassis for individual over road movement. When used on rail cars the service is know as “container on flat cars” with “COFC” as the abbreviation.

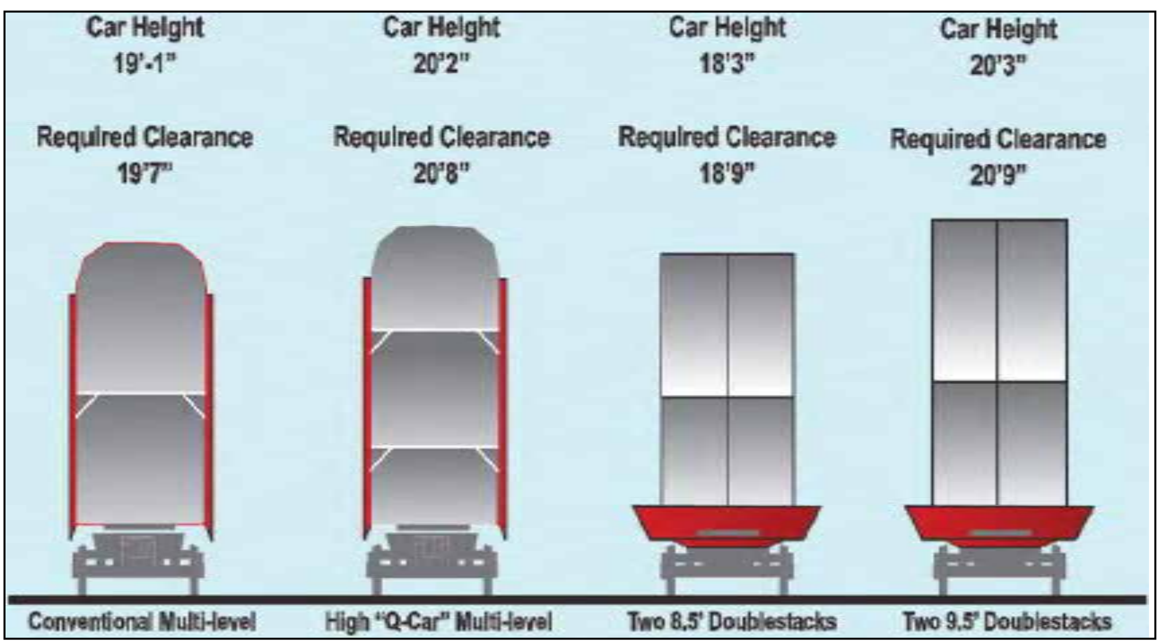
The expansion of intermodal TOFC and COFC traffic has been significant for the rail industry nationally, regionally, and within the Commonwealth. The use of COFC has been particularly important to the expansion of rail handling of international freight. Containers now are the dominant form of moving finished freight material internationally via container ship.

Major intermodal terminals located on the West Coast of the US and Canada provide a significant means for railroads to transport containers from the ports and "land bridge" them via rail across the country. The advantage of rail for this long haul of containers is based on the ability to place containers on trains up to 10,000 feet long. These trains can be operated with fewer employees compared to individual truck transport of each container. Additionally, the long haul movement of containers via train is significantly more fuel-efficient.

Secondary sources of container movements to New England and the Commonwealth are also related to connections to container ports in Montreal, Canada and the East Coast of the US, principally in New York and New Jersey. These opportunities do not have the long haul aspects of the West Coast connections, thus intermodal container business has been more limited for East Coast rail shipments to/from New England. Additionally, a significant issue for this movement is that all freight rail traffic must move to upstate New York to cross the Hudson River for the CSX and PAS lines in the Albany area. While there have been successful arrangements to move containers from the New York/New Jersey terminals to intermodal rail yards in central Massachusetts, the limited cost differentials and ability for transport directly to specific customers makes the use of truck very attractive to most freight container shippers and receivers within the Commonwealth.

One very significant consideration of movement of containers via rail is the available vertical clearance of a given rail line. The vertical clearance refers to the maximum height rail car that can be handled. The initial TOFC type of intermodal traffic required 19"6" or 19"7" of vertical clearance. Containers used in COFC movements allowed for the stacking of containers on a rail car. Initial COFC traffic was based on using the standard 8"6" containers that when double stacked also required 19"6" of vertical clearance. In the last twenty years, the shipping industry has move to the use of containers having a height of 9"6". When double-stacked, these higher containers require a vertical clearance of at least 20"8". Many times, the use of two full height containers is referred to as "full double" stack intermodal. This is illustrated in Figure 37.

Figure 37: Auto Carrier and Intermodal Rail Car Clearance Requirements

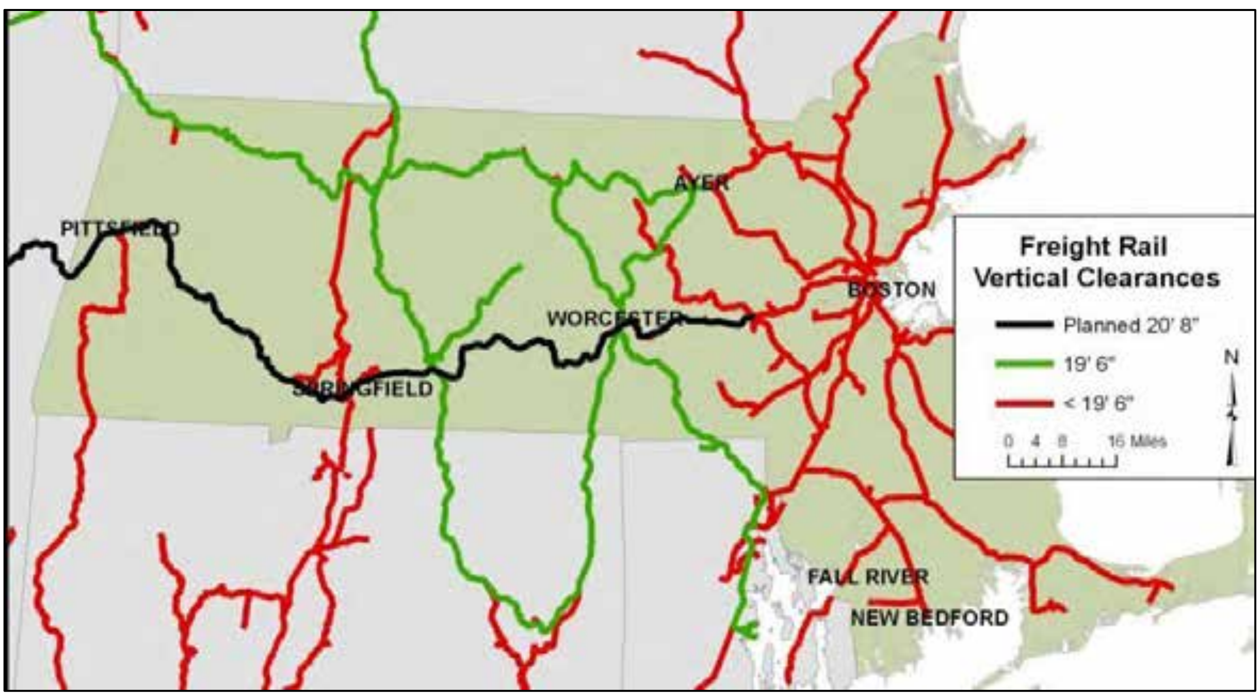


While significant attention has been paid to the concept of double stack intermodal traffic and the resultant need to clear the envelope to accommodate that traffic, the issue of vertical clearance extends beyond that issue to include the wide range of railroad equipment in use today. Sixty years ago, the majority of rail cars in the US did not exceed 15‟6" (AAR Plate C). In the past several decades, longer and higher railcars have become the norm in the industry, meeting demands by shippers for increased volume per rail car. New boxcars are built to either Plate E or Plate F standards (Plate E height is 15‟9", and Plate F is 17‟0"). Tank cars, gondola cars and regular flat cars continue to meet Plate C standards, while most covered hoppers, bulkhead and center-beam flatcars, newer boxcars and automotive and loaded intermodal cars exceed Plate C. An additional type of intermodal traffic that requires significant vertical clearance is the automotive rack cars used to handle new automotive vehicles from manufactures or ports of entry to automotive unloading facilities. Distribution of the new vehicles to local dealers is accomplished by truck auto carriers.

Vertical Clearance Existing Conditions in Massachusetts

Many rail corridors within the Commonwealth do not have sufficient clearance to support the highest intermodal container full double staff cars. As seen in Figure 38, there currently are no full double stack container routes within Massachusetts. As part of the CSX transaction between the Commonwealth and the railroad for the acquisition of rail lines east of Worcester, improvements to vertical clearances west of Worcester will be made as indicated by the "Planned 20‟-8"" corridor in Figure 38. This will allow full double stack trains to operate on the CSX line to intermodal yards in West Springfield and Worcester.

Figure 38: Current Vertical Clearances



As mentioned previously, interviews with shippers were conducted as part of the development of the Freight Plan. The lack of rail lines in Massachusetts to handle second generation double-stack intermodal trains was cited by many shippers as limiting the efficiency of rail options serving the Commonwealth. If the clearances were to be improved, it could increase the opportunity to divert trucks to rail from Worcester.

Estimates from rail and logistics stakeholder interviews indicated that increasing clearances could result in diverting between 5 and 15 percent of the truck traffic from the Port of New York/New Jersey. This would also help alleviate some of the highway congestion on I-84 and I-90. Lower clearances contribute to rail diversion as demonstrated by the Chicago to Boston container market. For routes from Chicago to New Jersey, where full double-stack clearances are available, the use of rail is generally favored over truck for long-haul container shipments based on feedback from third-party logistics firms. This contrasts to routes from Chicago to Massachusetts, without a Phase II full double-stack intermodal rail route, where the use of trucks to move freight to Massachusetts is more cost effective.

As noted above, the principal routes that would benefit from increased vertical clearance are the CSX mainline to Worcester and the PAS line to Ayer and potential continuing north to Maine, with improvements in New Hampshire and Maine. Improvements to the vertical clearance on the CSX mainline to Worcester are anticipated to be completed in the near future. In the rail investment scenarios considered in this Freight Plan, improvements of vertical clearance on the CSX line are assumed to be an existing condition for analysis purposes. The positive benefits of increasing the vertical clearance on the PAS line have also been examined.

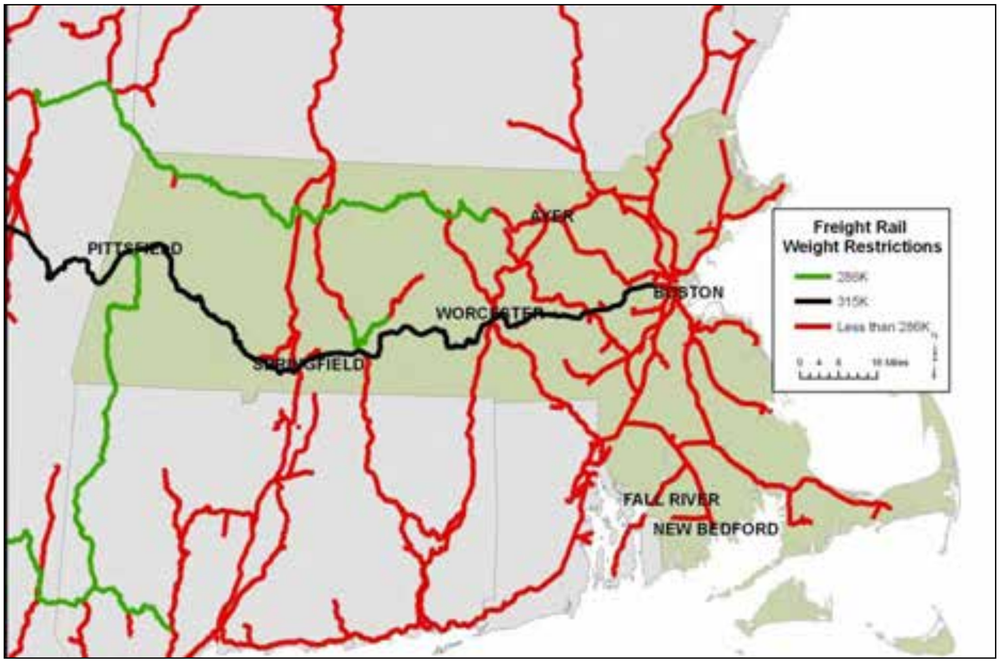
Weight on Rail

Rail lines are rated by the maximum weight rail car that can be carried on the rail line. The current minimum capacity that a rail line must be able interchange and handle is a 263,000 gross (total) weight rail car. However, in recent decades shippers have been employing freight cars with a gross weight of 286,000 pounds. As such, the official standard of 263,000 pounds is quickly being replaced by the heavier 286,000 pound rail cars. In some markets, rail cars with gross weight of 315,000 pounds are utilized.

The 286,000 pound rail cars provide for more cost effective transport of heavy products that provide benefits to shippers and receivers, and ultimately to consumers of products made with the shipped materials. Businesses in Massachusetts that cannot receive these heavier cars face delays in transit, extra costs for transloading, and the potential to see declining rail service.

Rail cars maximum weight limits in Massachusetts are illustrated in Figure 39.

Figure 39: Current Freight Weight-on-Rail Restrictions



Note: The PAS line from Mechanicville to Fitchburg is currently less than 286K weight-on-rail but is planned to be increased to 286K in the near future.

The Commonwealth‟s interest in this matter is one of maintaining a competitive playing field for Massachusetts based companies. As rail cars have increased in size and weight capacity, and as shippers take advantage of the larger cars, those companies that must rely on older, smaller cars, find themselves disadvantaged in the marketplace.

Consider the example of a grain mill supplier or a distributor of canned goods who loads 286,000 pound cars for the vast majority of its customers. If it has to load certain cars to a different (lighter) standard, it must "Load by Exception." This means that the shipper must either re-tool or readjust its loading pattern to meet the needs of these few customers. Charges will be assessed accordingly. Cars loaded by exception are also often loaded later than cars for other customers as matter of convenience. In addition, the receiver, in getting lighter cars, must order more railcars to secure the equivalent amount of product. All of these factors combine to make Massachusetts companies on 263,000 pound lines less competitive than companies located on 286,000 pound lines.

Only three railroads in Massachusetts have any significant amount of trackage that is approved for 286,000 pounds weight on rail.[33] The entire CSX Boston Line is rated to carry cars weighing up to 315,000 pounds, though secondary tracks (branch lines) are generally rated at 263,000 pounds. Certain limited portions of the P&W are rated to carry 286,000 pound cars, and the entire Housatonic Railroad (in Massachusetts and Connecticut) is rated at 286,000 pounds. All other railroads in the Commonwealth are currently rated at 263,000 pounds. The PAR Freight Main Line from Mechanicville, New York, is rated at 268,000 pounds. One of the

[33] The 286,000 pound discussion is based on four axle trucks. With the exception of specific heavy haul cars available at premium rates and utilized to move equipment such as transformers and other dimensional or overweight products, all the North American freight car fleet is equipped with four axle trucks. Loads can be moved by exception if six axle rail cars are utilized.

anticipated results of the upgrades contemplated in the creation of PAS is the ability to increase the allowed weight on this rail line to 286,000 pounds from Mechanicville, New York, to Ayer, Massachusetts.

Some of the 263,000 pound limits are driven by physical considerations including track conditions and bridge capacity, but a significant portion of the rail network in eastern Massachusetts is restricted to 263,000 pounds as a matter of policy. The track conveyed by Penn Central/Conrail and B&M/Guilford to the MBTA in the 1970s was transferred with then current load limits in place of 263,000 pounds. While the MBTA has rebuilt much of the rail infrastructure to support its commuter operation (and Amtrak service on the Providence Line), it has not changed the weight restrictions on any lines.

An assessment of the MBTA rail network may well find that the MBTA rail network is capable of sustaining heavier rail car loadings. Since the MBTA is only required by contract and deed restrictions to maintain the rail to levels it was deeded in the 1970s, there is no incentive for the MBTA to adjust the weight limit to 286,000 pounds. The reason for this is the expectation that if heavier freight rail cars run on the MBTA lines, there would be the need for an increased level of maintenance and costs. This concern could be addressed by negotiating new levels of fees with the freight carriers, as has been done on other commuter lines in the eastern United States.

2.4.4.4 Safety and Security Issues for Freight Rail

There are several areas of safety that warrant constant attention of both MassDOT and the public safety community. These are the areas where railroad operations intersect with the general public:

- Grade crossings (including implication of final rulemaking on whistles);
- Trespassing;
- Security; and
- Hazardous material transport.

2.4.4.5 Highway-Rail Grade Crossing Safety

At intersections with at-grade crossings of highway and rail modes of transportation, the issue of safety is paramount. Although the number of crossing accidents are fewer than vehicular accidents, the consequences are typically more severe due to the weight and speed of rail equipment involved. Crossing accidents put the safety of many people at risk, including vehicle occupants, as well as passengers and train crews.

In Massachusetts, the Department of Public Utilities (DPU) has responsibility and regulatory authority for grade crossing safety at all public highway-railroad grade crossings. Federal funds are available under Section 130 of federal surface transportation law to assist in eliminating or mitigating hazards at public highway-railroad grade crossings. The MassDOT Highway Division administers these funds and works with the railroads and communities to identify and construct priority projects.

The MassDOT Grade Crossing Program focuses on improving safety at existing highway-railroad grade crossings primarily through the installation of warning devices. Such devices include: standard signs and pavement markings; installation or replacement of active warning devices (flashers and gates); upgrading active warning devices, including track circuitry improvements and interconnections with highway traffic signals; crossing illumination; crossing surface improvements; and general site improvements.

Ultimately, the safest option regarding highway-rail grade crossings is to eliminate them, thereby removing the possibility of crashes. While in some cases it may be impractical or too costly to close crossings, such an objective can be achieved via crossing consolidation, and/or grade separation. It has been the policy of Massachusetts to reduce, wherever possible, the number of highway-railroad grade crossings on public thoroughfares. Dozens of highway-railroad grade crossings have been permanently closed under this initiative.

As of 2008, the FRA reported 1,359 highway-rail grade crossings in Massachusetts, of which 837 were active grade crossings located at public roads, as shown below in Table 8. Of the active crossings, 111 utilize only crossbuck signs as protection devices. All other known locations use active warning devices (e.g., lights, bells or gates). Although there has been significant progress over the past 30 years in upgrading the level of warning devices at the Commonwealth's public grade crossings, these systems need to be maintained. Maintenance and repair of highway-railroad grade crossing warning device equipment are the responsibility of the railroad owner. The FRA has established minimum inspection requirements for railroad maintenance of the warning systems, and each operating railroad is responsible for inspecting crossing system signals and equipment.

Table 8: Warning Devices at Public Highway Rail Grade Crossings in Massachusetts, 2008

Warning Device	Total	Percent of Total
Gates and Flashing Lights	321	38.4
Flashing Lights	283	33.8
Crossbucks	111	13.3
Stop Signs	8	1.0
Unknown	36	4.3
Special Warning	61	7.3
Bells only	14	1.7
Other	3	0.4
Total	**837**	

Source: U.S Department of Transportation, Federal Railroad Administration (FRA), Railroad Safety Statistics, 2008 Preliminary Annual Report (Data as of February 2010), Table 9-4

Table 9 shows that from 2004 to 2008, there have been a total of 49 incidents at public highway-rail crossings and 8 incidents at private highway-rail crossings in Massachusetts, of which 7 were fatal. According to Massachusetts Operation Lifesaver, Inc. (OLI), although railroad traffic in the Commonwealth of Massachusetts has been increasing in recent years, casualties associated with crashes at crossings remains low. However, the number of incidents associated with trespassing, while small, is high based on the miles of rail lines in the Commonwealth.

Table 9: Total Highway-Rail Crossing Incidents

Year	At Public Crossing	At Private Crossing
2004	15	3
2005	10	1
2006	10	1
2007	7	2
2008	7	1
Total Fatal	6	1
Total Nonfatal	45	3
Total	**49**	**8**

Source: US Department of Transportation, Federal Railroad Administration (FRA), Railroad Safety Statistics, 2008 Preliminary Annual Report (Data as of February 2010), Table 1-12

2.4.4.6 Security of Freight Rail

In addition to the safety and security issues described previously, freight railroads have additional security concerns. Following the events of September 11, 2001, the AAR established the Railroad Security Task Force. That task force produced the "Terrorism Risk Analysis and Security Management Plan" designed to enhance freight rail security. The plan remains in effect today.

As a result of the plan, freight railroads enacted more than 50 permanent security-enhancing countermeasures. Communication among security officials, law enforcement and the railroads is critical to ensuring secure operations in Massachusetts‟ rail transportation system. The AAR and the American Shortline and Regional Railroad Association (ASLRRA), as well as their member railroads, work cooperatively with TSA in implementing a range of safety, security and communications procedures. The details of these programs are subject to security controls and are not generally available to the public.

2.4.4.7 Hazardous Materials

Railroads are required to comply with federal and state regulations regarding safety and hazardous materials handling and reporting requirements. There are numerous safety and security concerns related to the movement and handling of these hazardous materials, particularly when these movements are within close proximity to populated areas and on the Commonwealth‟s rail lines, which are shared with passenger service. Under authority delegated by the Secretary of Transportation, the FRA administers a safety program that oversees the movement of hazardous materials, including dangerous goods such as petroleum, chemical, and nuclear products, throughout the nation‟s rail transportation system. FRA‟s role in the safety program also extends to shipments transported to and from international organizations. The FRA also has authority to oversee the movement of a package marked as hazardous, to indicate compliance with a federal or international hazardous materials standard, even if such a package does not contain a hazardous material.

The FRA‟s current hazardous materials safety regulatory program includes the following items:

- Hazardous Materials Incident Reduction Program;
- Tank Car Facility Conformity Assessment Program;
- Tank Car Owner Maintenance Program Evaluations;
- Spent Nuclear Fuel and High-Level Nuclear Waste Program;
- Railroad Industrial Hygiene Program;
- Rulemaking, Approvals, and Exemptions;
- Partnerships in Domestic and International Standards-Related Organizations (e.g., AAR, American Society of Mechanical Engineers (ASME), Transportation of Dangerous Goods/Canadian General Standards Board (TDG/CGSB); and
- Education, Safety Assurance, Compliance, and Accident Investigation.

On November 26, 2008, TSA and DHS published a new final rule applying to the transportation of certain kinds of highly hazardous materials.[34] On that same day, a US DOT rulemaking was finalized that applies to railroad carriers, focusing primarily on routing and storage in transit.[35]

The freight rail provisions of the TSA rule address the transport of security-sensitive materials by rail from start to finish, including shipment handoffs, secure areas for transfers, and the reporting of shipment locations to TSA. The designation of rail security coordinators for passenger and freight rail carriers also is mandated by the Rail Security final rule, and all significant security concerns must be reported to the TSA. The rule also codifies TSA‟s broad inspection authority.

Requirements preventing hazardous material transport through certain cities may result in network congestion and increase the length of haul for these substances. This could increase operating costs, reduce operating efficiency, and result in a greater risk of an accident involving hazardous material transportation. Application of these rules is under consideration and may affect most freight routes. The impact to Massachusetts rail railroads will be identified as the rules are implemented. Noncompliance with these new rules may result in significant penalties to the noncompliant entity and may be a factor in litigation that results from a train accident.

2.4.4.8 Federal and Commonwealth Roles for Freight Rail Safety and Security

The primary government agency charged with the responsibility for regulating, monitoring and improving safety on the nation‟s rail system is the FRA. Legal considerations of rail safety and security in Massachusetts and the United States, for that matter, are regulated by the FRA. Post September 11, 2001, however, the United States Department of Homeland Security (DHS) and the Transportation Security Administration (TSA) have been assigned oversight of aspects of both passenger and freight rail operations.

In 1970, Congress determined that there was a need for further legislation to improve the safety of the nation‟s railroads, and they enacted the Federal Railroad Safety Act of 1970. The bill gave FRA specific authority over all rail safety related matters and authorized the FRA to establish civil penalties for violations of the regulations issued under the Act. The passage of the 1970 Act provided the railroad safety program with a new and fundamentally different charter, which included:

[34] http://edocket.access.gpo.gov/2008/pdf/E8-27287.pdf
[35] Ibid.

- Broad regulatory authority to address all areas of railroad safety;
- Strong emphasis on national uniformity of safety standards;
- Effective sanctions, including the ability to address emergency situations; and
- Commonwealth participation in enforcement of national standards.

Subsequent legislation passed during recent years has increased the FRA‟s regulatory authority. Notable related changes have been associated with limits for hours of service of employees operating trains and maintain signal systems.

Federal regulations pertaining to railroad safety are described in Title 49 CFR, Subtitle B, Chapter II. Railroad companies must submit a record of all highway-rail grade crossing accidents to the FRA within 30 days of occurrence, as required in 49 CFR, Part 225. All Highway-rail grade crossing accidents must be reported by the railroad. If death or injury from such an accident does occur, then the accident must be filed on Form FRA F 6180.55a.

The FRA regulates grade crossing signal system safety in 49 CFR, Part 234. This part prescribes minimum maintenance, inspection, and testing standards for warning systems at highway-rail grade crossings, and it defines standards for reporting and taking action on system failures.

The FRA also requires railroads to conduct periodic inspections of track in as stipulated in the Track Safety Standards of 49 CFR Part 213. The railroads must use qualified inspectors and maintain records for FRA review. FRA inspectors will also perform independent inspections. This same procedure applies to railroad structures, such as bridges, as well.

During the past several years, there have been a number of new regulatory requirements and initiatives enacted by FRA and required by the Rail Safety Improvement Act of 2008. The new FRA regulations focus on human factors in rail safety. They include stringent requirements for the testing and inspecting of the performance of railroad operating crews and for better training and qualification of the supervisors conducting the testing and inspection programs.

The new rail safety law establishes a number of new safety initiatives and required programs, which include a timeline for their implementation. Some of the principal elements of the new law include:

- Positive Train Control, a collision avoidance system;
- Performance monitoring requirements;
- Railroad safety risk reduction program; and
- Grade crossing safety.

All of these required programs apply to Amtrak passenger rail service in Massachusetts and will have to be developed and implemented according to the timeline specified in the safety law. One mandate is the implementation of Positive Train Control (PTC) that must be implemented by 2015 by intercity and commuter railroads that operate over freight main lines that transport certain hazardous materials.

Some of the safety and security challenges are common to both passenger and freight modes, while others are unique to specific rail operations. A number of challenges center on securing passenger operations, improving the rail system, and fortifying rail security. Open access to rail lines and rail stations, as well as the high levels of mass transit ridership make railroads more difficult to secure than airports. The challenges faced by both modes are described in the section immediately below, while the issues specific to passenger and freight rail are outlined separately later in the chapter.

2.4.5 FREIGHT RAIL OPPORTUNITIES

As discussed in this chapter, there are a number of opportunities and benefits related to freight rail in Massachusetts. In particular, relatively high fuel prices tend to make freight rail more competitive with trucks as rail has “per ton mile” advantages of lower shipping costs, greater energy efficiency, less air emissions, and benefits to the highway system in terms of congestion relief, safety, and pavement damage. Nationally, freight rail is gaining in prominence due to these public benefits and the growing use of public-private partnerships to fund a range of freight rail improvements. A summary of key opportunities includes:

- **Rail Network –** Massachusetts has generally strong rail network coverage that reaches most areas in the Commonwealth. The Commonwealth‟s rail network represents about 25 percent of the entire network in New England although it carries more than 40 percent of all freight moving through New England.
- **Rail Impacts –** Freight shipped by rail rather than truck can reduce highway traffic congestion, emissions, and pavement impacts.
- **Vertical Clearances –** Restrictive vertical clearances on most of the Massachusetts freight rail network impact the ability of shippers and receivers to experience the efficiency and cost effectiveness benefits of double-stack rail service. This issue is currently being addressed on the CSX Boston Line from the New York border to Westborough. As described in the freight investment scenario analysis in Chapter 4, there are other rail corridors in the Commonwealth that could benefit from double-stack rail capacity that would lead to more competitive, lower cost routes for rail shipments.
- **Weight Restrictions –** Much of the rail system is not designed and/or permitted for the emerging rail industry standard weight of 286,000 pounds, requiring “loading by exception” for Massachusetts and limiting the accessibility to these routes and more cost-effective shipping practices for bulk products. This deficiency is most prevalent on the regional and short-line railroads that provide deliveries and shipments throughout the Commonwealth. Providing connected and complete rail corridors with 286,000 pound weight-on-rail capacity could lead to greater freight rail volumes as is evaluated in Chapter 4.
- **Rail Access –** Rail access for many potential customers along rail lines needs to be built or upgraded, an expense that may limit opportunities to ship by rail. Development pressures on rail-adjacent land reduce the potential pool of rail customers. New industrial sites may not have rail access. Chapter 3 provides a detailed examination of this industrial land use development issue and suggests potential enhancements to strategically preserve and facilitate rail customers where appropriate.
- **Shared Use, Rail Congestion and Competing Demands –** Much of the freight rail system operates on corridors that also have passenger rail (commuter and/or intercity rail) which creates challenges for scheduling and dispatch, safety, and the need for suitable switching and signal equipment. Shared use operations often require double-tracking and passing sides for the most heavily traveled routes (e.g., Northeast Corridor, Worcester-Boston, Downeaster route). A current initiative by MassDOT is the recently advertised project to examine the Inland Route and Boston to Montreal passenger rail corridors. While the emphasis is on passenger rail, a key corridor for this project is the Worcester to Springfield CSX Boston Line which is generally single track

with significant curves. Potential improvements to this corridor will need to explicitly consider shared use of freight and passenger trains.

- **CSX Transaction –** MassDOT and CSX recently announced an agreement to relocate and consolidate the Beacon Park intermodal yard, in conjunction with planning to provide second generation (20‟8”) double-stack capability between Worcester and the western border. This agreement is expected to enhance freight rail opportunities to Worcester with expanded passenger rail between Worcester and Boston. This initiative is leading to an expanded intermodal rail facility in Worcester to handle more rail shipments to and from the region. The transaction also allows Massachusetts to own the critical southeast rail corridors necessary to implement the planned South Coast Rail project with passenger and improved freight connections to New Bedford and Fall River.
- **Pan Am Southern (PAS) –** Pan Am Railways and Norfolk Southern have partnered to establish the Patriot Corridor as a second competitive Class I railroad in the Commonwealth, with first generation (19‟6” as limited by the Hoosac Tunnel) double-stack capability and 286,000 pound weight-on-rail capacity between Ayer and the western border. Leveraging this investment, this plan considers other rail improvements that could further boost freight rail opportunities such as 286,000 pound weight-on-rail projects on corridors connecting to the Patriot Corridor as well as consideration of the potential to provide double-stack vertical clearance on the Patriot Corridor.

A complete evaluation of potential freight rail enhancements is presented in Chapter 4.

2.5 MARINE TRANSPORTATION AND SEAPORTS IN MASSACHUSETTS

Seaports are gateways to domestic and international trade. They connect cities, regions, and countries all over the world. They enable the transport of goods and services to destinations that would be difficult to reach by any other transportation mode. More than two billion tons of domestic and import/export cargo are handled annually by US ports and waterways.

The Commonwealth of Massachusetts boasts five major ports: Boston, Gloucester, Salem, New Bedford and Fall River. These industrial port areas of the Commonwealth represent an important economic asset, one the Commonwealth and the public at large are committed to preserving and growing. The Commonwealth‟s ports provide jobs, support local businesses, and promote domestic and international trade.

The following section provides an overview of marine transportation and ports. It also describes each of Massachusetts‟ ports in detail by offering background information and an assessment of the port‟s infrastructure and facilities. Additionally, issues, constraints, and bottlenecks are highlighted, including those related to the environment, safety, security, and economic development. Freight growth potential and other opportunities are also discussed.

2.5.1 BACKGROUND ON MARINE TRANSPORTATION AND PORTS

Ports, more than the surface transport modes, are products of a globalized world. Transport over water bridges gaps between continents and countries, making ports critical to world trade and to the economic growth of a country. They are pivotal components of a country's transportation system, gateways for trade, and potential platforms for a global logistics network.

While their self-defined mission is to sustain their competitive position, ports must meet global and world-class standards when they function as part of a global transportation network.

Improved access to the port, through the port, and to other modes of transport, achieved through increased productivity and efficiency in cargo handling, makes a port more competitive. Optimization of these productivity/efficiency factors is increasingly determinative of the selection of a port.

The United States is served by publicly and privately-owned marine facilities located in ports along the Atlantic, Pacific, and Gulf Coasts, as well as in Alaska, Hawaii, Puerto Rico, Guam, and the US Virgin Islands. The trade volumes (TEUs), relative size, and growth of West, East, and Gulf Coast ports in recent years are provided in Table 10. Based on data reported in October 2008, West Coast ports account for a greater market share than East Coast ports, in terms of container volumes. The large West Coast volumes are led by the ports of Los Angeles and Long Beach and the import shipments from Asia. These data, however, indicate a narrowing of the gap with container volumes at East Coast ports now only trailing West Coast ports in volume handled by six to eight percentage points. East Coast ports have been gaining due to a combination of port capacity improvements, marketing initiatives, and competitive shipping times for freight traveling west from European markets.

Table 10: US West, East and Gulf Coast Port Container Volumes, Year-to Date, Year-over-Year 2007-2008

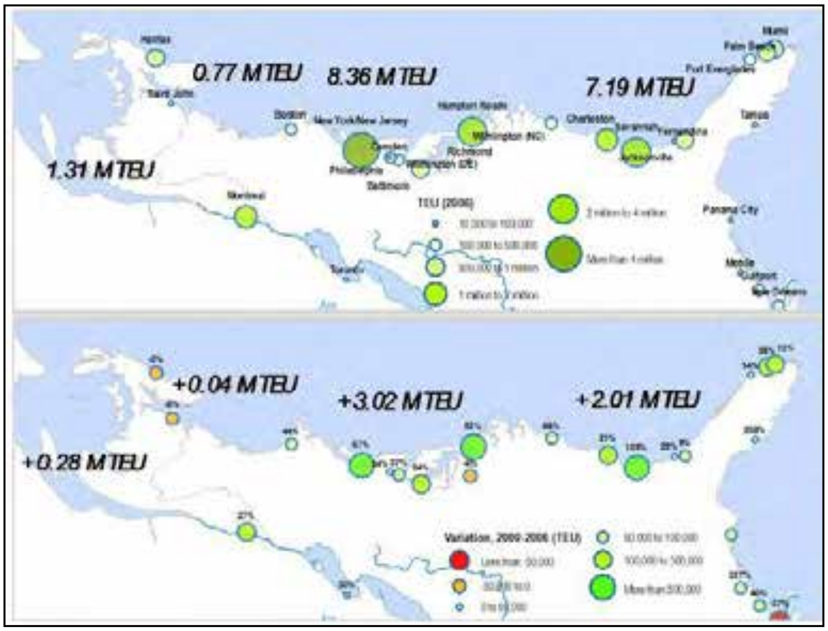
	TOTAL TEU TRADE		YTD	Market Share		TOTAL TEU TRADE		Oct 2008	Market Share	
	YTD 2008	YTD 2007	Growth	YTD 2008	YTD 2007	Oct-08	Oct-07	YOY	Oct-08	Oct-07
TOTAL U.S.	**24,187,190**	**24,153,282**	**0.1%**	**100.0%**	**100.0%**	**2,399,514**	**2,574,329**	**-6.8%**	**100.0%**	**100.0%**
WEST COAST	**12,179,455**	**12,459,056**	**-2.2%**	**50.4%**	**51.6%**	**1,185,436**	**1,298,557**	**-8.7%**	**49.4%**	**50.4%**
LA	4,849,675	4,801,472	1.0%	39.8%	38.5%	462,191	507,962	-9.0%	39.0%	39.1%
LB	3,977,334	4,181,668	-4.9%	32.7%	33.6%	399,018	428,671	-6.9%	33.7%	33.0%
OAK	1,199,635	1,209,376	-0.8%	9.8%	9.7%	116,874	121,966	-4.2%	9.9%	9.4%
TAC	978,366	963,431	1.6%	8.0%	7.7%	92,418	103,506	-10.7%	7.8%	8.0%
SEA	942,554	1,069,560	-11.9%	7.7%	8.6%	92,164	113,743	-19.0%	7.8%	8.8%
EAST COAST	**10,305,251**	**9,979,238**	**3.3%**	**42.6%**	**41.3%**	**1,032,183**	**1,083,318**	**-4.7%**	**43.0%**	**42.1%**
NY	3,416,080	3,277,935	4.2%	33.1%	32.8%	338,736	360,948	-6.2%	32.8%	33.3%
SAVANNAH	**1,820,107**	**1,701,596**	7.0%	**17.7%**	**17.1%**	**182,126**	**193,554**	-5.9%	**17.6%**	**17.9%**
NOR	1,359,681	1,297,487	4.8%	13.2%	13.0%	142,519	151,227	-5.8%	13.8%	14.0%
CHA	1,158,756	1,182,795	-2.0%	11.2%	11.9%	113,725	110,817	2.6%	11.0%	10.2%
PEV	585,882	573,535	2.2%	5.7%	5.7%	55,434	60,477	-8.3%	5.4%	5.6%
MIA	571,055	568,178	0.5%	5.5%	5.7%	59,236	57,942	2.2%	5.7%	5.3%
GULF	**1,702,484**	**1,714,988**	**-0.7%**	**7.0%**	**7.1%**	**181,894**	**192,453**	**-5.5%**	**7.6%**	**7.5%**
HOU	1,169,886	1,186,185	-1.4%	68.7%	69.2%	128,781	135,421	-4.9%	70.8%	70.4%
MOBILE	64,334	56,272	14.3%	3.8%	3.3%	5,516	6,002	-8.1%	3.0%	3.1%

Source: October US Port Rankings-Journal of Commerce

East and West Coast ports have capacity, congestion, and equipment issues requiring major investments in dredging, terminals and equipment, distribution warehousing, and rail. East Coast ports have been developing capital investment strategies, but it will take time and funding resources to fully implement them.

In 2008, the largest ports on the North Atlantic east coast in terms of twenty-foot equivalent Units (TEUs) were the Port of New York and New Jersey (PONYNJ), Savannah, Norfolk, and Charleston. Relative to these ports, Boston is a small port, but it is important in the immediate New England region. The cluster of these largest and fastest growing ports in the mid-coastal range, where geography and rail infrastructure privileges them in the potential for double stack rail access benefits to the country‟s interior and other points, is shown in Figure 40.

Figure 40: East Coast North American Port Container Traffic, 2003-2006

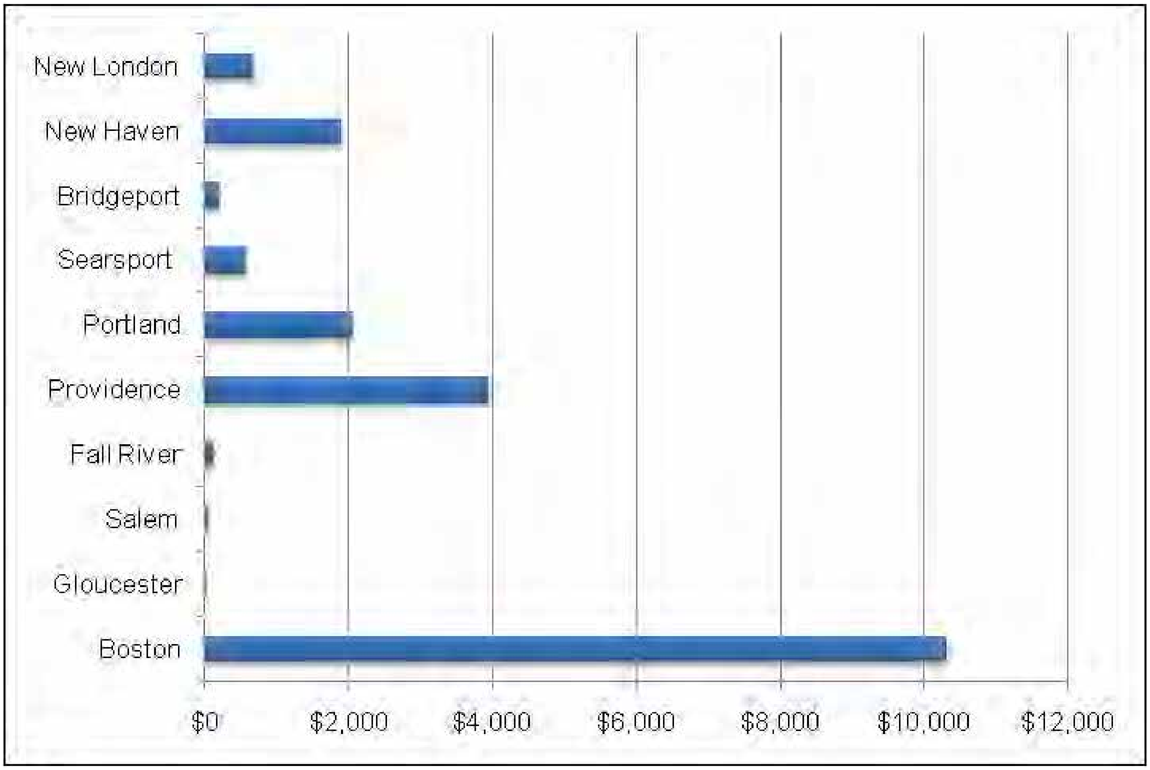


Source: Port Hinterland Divergence along the North American Eastern Seaboard, Rodrigue and Guam, Draft 4/08

Within New England, the Port of Boston (POB) is the largest container port. This is reflected in Figure 41, which shows Boston‟s dominance among New England ports in terms of cargo values.[36] Providence, Rhode Island, and Portland, Maine, reported the second and third largest values of cargo, respectively. Portland is the largest port in New England in tonnage, serving as a gateway for petroleum products destined for eastern Canada, as well as northern New England. Boston is the second largest port in tonnage in New England. Other Massachusetts ports, Fall River, Salem, and Gloucester, are significantly smaller in terms of cargo values, as illustrated in Figure 41.

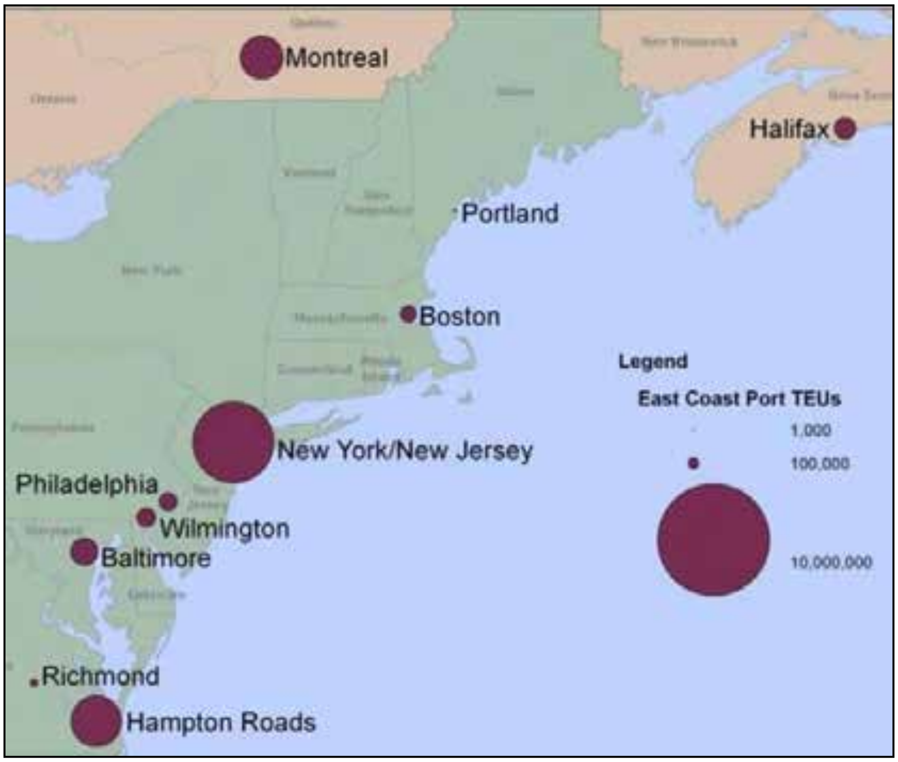
[36] STAT-USA & Foreign Trade Division, US Census Bureau www.usatradeonline.gov; comparable data is not available through the source for New Bedford, Portsmouth, Quonset/Davisville, Portsmouth, Eastport.

Figure 41: New England Port Cargo Values ($Millions), 2007



The Port of New York/New Jersey dominates the northeast for maritime containers handled (Figure 42). From a Commonwealth perspective, Massachusetts Port Authority (Massport), owner of the Port of Boston, estimates that the Port of Boston serves about 30 percent of the region"s waterborne freight, helping to explain the large amount of freight flows from New York to Massachusetts with heavy truck volumes on I-84, I-90 and throughout the Boston metro area.

Figure 42: Containers (TEUs) Handled by Northeast Ports, 2008



Source: American Association of Port Authorities

As estimated by Massport, 75 to 90 percent of freight moving through the Port has its landside origin and destination within 100 miles of the Port. Currently, it serves 30 percent of New England"s waterborne cargo market, up ten percent from eight years ago. Massport sees growth opportunity in POB"s proximity to most New England shippers, a significant geographic advantage. This proximity saves them inland transportation costs and provides them with all-water service to the Port that is less expensive and competitive in terms of travel time with rail (landbridge) transport from the West Coast.[37]

2.5.1.1 Port Standards

To meet world class standards today, a port must serve as a platform for integration:

- Across waterborne, landside modes of transport;
- Across transport, product logistics systems; and,
- Of systems across region, country, globe.

There are other factors affecting marine transport, including the local, national and global economy. For example, maritime freight transport costs can be profoundly affected by economic trends. In Massachusetts, there is an industry mix of more high-tech, value-added goods, and less bulk cargo.

Although the cost of oil has been a recent concern, maritime freight rates are determined by a number of other significant factors including:[38] trade imbalances (import/export ratios);

[37] *New England Logistics* JOC Special, 11/08.
[38] UNCTAD Transport Newsletter, No. 39, Second Quarter, 2008.

economies of scale; levels of port competition; port infrastructure; private sector participation in port operations; and type and value of goods traded. Furthermore, maritime freight rates represent a fraction of total trade transaction costs. Other associated factors can also significantly mitigate or magnify effects of the cost of maritime transport, such as efficiency gains and technological improvements.[39]

2.5.1.2 Standards for Port Competitiveness

Efficient Terminal Operations

Port throughput is the essential measure of a terminal and port‟s effectiveness. The higher the volume handled through facilities, generally the lower the per-unit cost will be. Depending on the type of operations, throughput can vary dramatically but one essential standard used in the industry applies specifically to container operations. Many container terminals are public terminals, meaning that any carrier can use them. Terminal efficiency is a function of spatial use, operational management, labor efficiency, traffic flow, storage and dwell times, crane cycling and vessel handling. To quantify terminal efficiency, the industry uses a general standard ranging between 1,500 TEUs per acre at the low end to about 2,500 TEUs per acre at the high end.

Modern and Reliable Terminal Equipment

Terminals use vastly different types of handling equipment, depending on the type of cargo they manage. For container operations, the most common types of handling equipment used at terminals includes shore-based cranes for shore/vessel transfers, chassis units for on terminal and delivery activities, top loaders for stacking containers, gantry cranes for stacking containers to higher levels shoreside, and yard hustlers for handling chassis. Shore-based cranes for shore/vessel transfers are often the key choke point for terminal efficiency. Most large terminals have gantry cranes that can reach over vessel hatches and quickly guide containers in and out of the vessel‟s cells. Gantry efficiency generally averages at about 25-30 picks or movements per hour. The second type of crane, generally used at smaller terminals, is the mobile harbor crane. Similar to construction cranes, they have a long reach, higher lift capacity, and flexibility in placement. Average cycle time is between 15 and 20 picks per hour.

Skilled and Cost-effective Workforce

Terminals need to have skilled and trained personnel who can meet modern cargo handling demands. Personnel need to be computer literate and capable of handling complex and precise cargo handling equipment. The labor arrangements at terminals, in regard to the number of personnel and their respective jobs, need to be reasonable and not cost prohibitive.

Terminal Flexibility

Market conditions change rapidly in the maritime industry. Terminals are often designed to accommodate one specific type of cargo and then when conditions change, they become encumbered by infrastructure that had been developed for a specific role. Most modern terminals are tending toward designs with much open space, flexible traffic patterns, and fixed infrastructure located away from the main portion of the site and clear of the wharves and berths. This allows the yard to be reconfigured as necessary to meet changing demands. One growing concern is that aging infrastructure needs to be repaired or rebuilt. There are a number of terminals that have a large footprint but only limited usable space, as landing and

[39] Ibid.

support weights from structural deterioration become lower. Other terminals, especially those in dense urban areas, are space-constrained due to adjacent development.

Room for Expansion

Marine terminals often face the same issue that many airports face, encroachment not only on the terminal proper but also the access roads and rail corridors. Waterfront property has become very valuable in recent years and is a prime target for commercial and residential real estate interests. This ongoing non-industrial development of waterfronts often takes deepwater shore areas out of industrial use and limits terminals from expanding to meet increased volume. Container terminals alone, without equipment and buildings, average approximately $1 million per acre to acquire and develop.

Unencumbered Road and Rail Access

While many marine terminals may be located in areas where they are not threatened by encroachment by non-industrial uses, roads and rail rights of way often become choked with development or are encumbered by buildings or overhead limitations. These restrictions on access routes and corridors can severely hamper the ability of a terminal to move cargo in and out quickly. Property needs to be protected or acquired for future industrial development when available, to ensure that a terminal can expand and adapt. In addition, strict zoning to protect corridors and avoid traffic or development conflicts needs to be put in place by port communities, such as the Commonwealth of Massachusetts Designated Port Area (DPA) protections.

Terminal Highway Connections

Efficient connections to the Interstate highway system from access roads are also a critical element for terminal access. Many ports have designated seaport access roads with exclusive on and off ramps to prevent tie-ups and roadway congestion. One method employed successfully has been the development of shared corridors with rail rights of way. These corridors are generally very effective and provide unencumbered access to terminal areas and interstate roadways.

Direct Rail Access

While trucks serve local markets well, rail is often the best mode to reach longer-distance inland markets. Direct rail access, on dock or in close proximity to a port, for loading and unloading of rail cars, makes container handling more cost effective, eliminating or reducing the cost of truck dray between port and rail facilities.

Double-stack Capability

Rail corridors need to be cleared to a minimum of 20 feet 8 inches to permit specialized rail cars that carry one level of containers on top of another. While this is desirable from a national competitiveness perspective, many successful ports, such as the Port of Boston, do not have this type of direct rail connection.

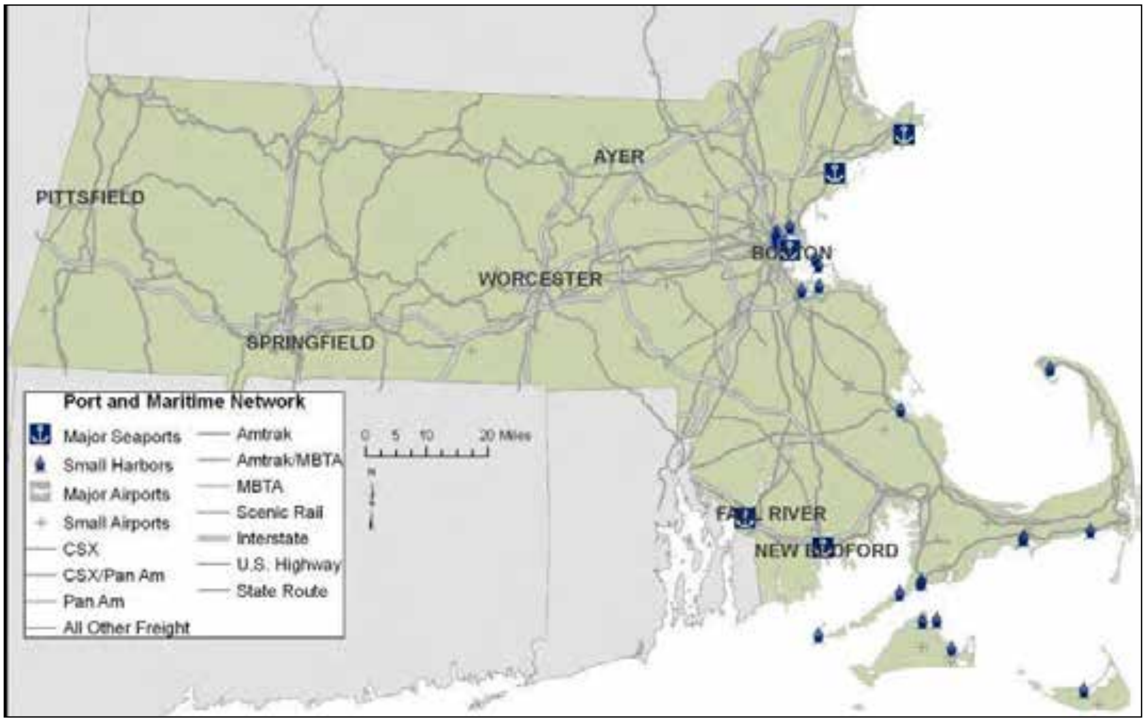
Global Management

Ports, or regions that manage their collective facilities cooperatively or under the same management authority, often sustain growth more effectively because competition for financial resources is limited. Ports need to engage professional management and partner with the private sector to expand opportunities and create efficiencies. Rail and marine terminal operators are venturing into becoming transportation companies handling every aspect of cargo transportation "door to door." In addition, many public entities that operate ports are tending toward leasing facilities out to private sector entities, which are becoming partners in both development and investment of marine facilities.

2.5.2 MAJOR SEAPORTS OF MASSACHUSETTS

There are five major ports in Massachusetts: Boston, Gloucester, Salem, New Bedford, and Fall River as shown in Figure 43. These are ports with substantial maritime industrial activity and the infrastructure landside and waterside on which this activity depends.

Figure 43: Massachusetts Port and Maritime Infrastructure



These industrial port areas of the Commonwealth represent an important economic asset, one which the public has a strong interest in protecting. Ports are uniquely dependent upon a waterfront location with special infrastructure (e.g., deep navigation channels and easy rail and road access), requiring a substantial prior investment. Such locations, which are few in number and have been steadily disappearing, are a non-renewable coastal resource. Competitive pressure to develop them for non-industrial use has been intense. In recognition of the threat to this economic asset, the Commonwealth established the Designated Port Area (DPA) Program to protect locations that have historically played a significant role in the Commonwealth‟s maritime economy.[40] The Commonwealth‟s five major ports include sizeable DPAs.

Commonwealth policy on DPAs is implemented through both state regulations and funding support. A major source of Commonwealth funding is provided through the Seaport Revitalization Act, known as the so-called Seaport Bond Bill, enacted in 1996. With changes in the DPA regulations designed to improve achievement of the goals of the program, many of the

[40] http://www.mass.gov/czm/permitguide/regs/dpa.htm

Commonwealth‟s major ports have developed DPA master plans. These plans reflect a Commonwealth and local consensus on "multi-use port areas," and state funding has lent critical support to development and implementation of these port plans. It should be noted, however, that DPAs in Massachusetts have faced significant challenges both in terms of compensation to private land owners as well as requests to limit the size and coverage of DPAs.

The primary freight-related business lines of these five major ports include shipping (container, breakbulk, and bulk cargoes) and seafood industry (harvesting and processing) operations, distribution warehousing, and power plants. Detail on the channel depths, throughput, capacity, cargo types, and volumes of these ports is provided in Table 11.

Table 11: Massachusetts Ports: Channel Depths, Throughput, Capacity, Cargo Types, and Volumes

Port	Depth (F)	Facility	Size acres	Through-put	Capacity	Freight-related Business Lines	Cargo types	Commodities	Total Cargo Volumes Short Tons (2007)[51]
Boston	40	Conley Container Terminal	101	2,140 containers/ acre	220,000+ TEUs	Shipping	Container	Mix	
		Autoport			50,000 autos	Shipping	Neobulk	Autos	
		88 Black Falcon and International Cargo Center of New England			480,000 SF	Distribution Warehousing			
		Fishing Processing			277,000 SF	Fishing Industry			
		Petroleum			5.1 million gallons		Bulk	Petroleum products	
		Liquid Natural Gas		715 million cubic feet/ day	42 million gallons		Bulk	Liquid Natural Gas	
		Power plants			1600 megawatts		Bulk	Natural gas	
		Private dry bulk			Not available		Bulk		
								All Boston Ports:	**16,801,258**
Gloucester	20	Jodrey State Fishing Pier	7.8		54- commercial fishing vessel berthing capacity; freezer/ cold storage capacity	Fishing Industry		Fish, fish processing products	
								All Gloucester Ports:	**1,887**
Salem	32	Salem Power Station	67		100,000 tons of coal; 1 million barrels of oil; 745 megawatts	Power Plant	Bulk	Coal, oil	
								All Salem Ports:	**780,493**

Port	Depth (F)	Facility	Size acres	Through-put	Capacity	Freight-related Business Lines	Cargo Types	Commodities	Total Cargo Volumes Short Tons (2007)
New Bedford	30	New Bedford State Pier			135 container storage; 125,000 SF covered storage; 100X80-F RoRo ramp	Shipping	Breakbulk	House goods	
		Multiple Terminals			500+ commercial fishing vessels; fish processing and cold storage; petroleum handling; development capacity	Shipping, Fishing Industry; Distribution Warehousing	Breakbulk, Bulk	Perishables, fresh, frozen fish	
								All New Bedford Ports:	**Not available**[1]
Fall River	35	Fall River State Pier	5.1	60 TEUs/ month-2007	250-500 TEU weekly for initial coastal shipping barge service; 1.53 cubic F covered unheated storage; 100 SF open storage; Roll-n/Roll-off ramp 80-F width	Shipping, Fishing industry	Containers, breakbulk, bulk, vehicles, heavy equipment	Fresh and frozen fish, vehicles, heavy equipment	
		Commodity chemical manufacturing	26		9000 short tons annually	Industry	Bulk	Chemicals, liquid latex	
		Power plants			3,325 short tons annually, 1720 Megawatts	Power plants	Bulk	Coal, petroleum products	
								All Fall River Ports:	**2,295,556**

2.5.2.1 Port of Boston

As with major historic port-cities everywhere, the Port of Boston has overlapping and competing port, city, and Commonwealth interests concerning economic development, land use and water use. In Boston, Massport, the largest public port landowner in Boston, is a Commonwealth authority, with a dual role, as public agency serving the public interest, and business, needing to be mindful of its bottom line. Over the past decades, Massport, the City of Boston and the Commonwealth of Massachusetts have made significant strides in reconciling their conflicts, and continue in these attempts.

The Port of Boston is located on Massachusetts Bay within Boston Harbor and is approximately 218 miles north of New York. The largest of Massachusetts" five ports, it holds the central location between them, with Gloucester and Salem to its north and New Bedford and Fall River to its south.

Figure 44: Northeast Shipping Routes

The Port of Boston is located adjacent to the main shipping routes between southern and northern New England and is situated between the larger ports of New York and Halifax, Nova Scotia. Within New England, Portland, Maine, is the largest port in tonnage. The Port of Boston is the second largest tonnage port and the largest container port; it is the largest oil port in Massachusetts.

The Port is surrounded by a large consumer market, and beyond the environs of the inner hub there exists a large population base connected by several major interstate and arterial roadways. A substantial number of major retail and service industries are located in Boston and outlying areas, many of which rely on the Port and its access to several direct call import-export container services. There is a developed distribution network for container cargo and petroleum products, as well as US Customs facilities in the Port for the processing of imports. The largest international passenger port in the region, Boston is also a popular tourist destination, with excellent intermodal and air connections in support of its growing cruise ship trade.

The Port is historically known for its wide range of maritime activity including cargo operations handling containers, petroleum, liquefied natural gas, dry bulk such as salt and scrap metal, automobiles, and fishing industry (harvesting and processing) operations. It handled a total of 15.5 million tons of cargo in 2007 at public and private facilities, including 1.5 million tons of bulk non-fuel cargo and almost 13 million tons of fuel.

The Port of Boston also hosts two shipyard facilities, several commuter ferry operations, marine research activities, marinas, and the largest US Coast Guard facility in New England. It has significant support mechanisms in place for commercial vessel activity, as well as the largest support center for marine activities in New England, including competitive tug, bunkering and other services.

Industrial port facilities are located in South Boston and Charlestown, as well as in nearby Everett and Chelsea. The Massachusetts Port Authority (Massport) is a public and important port entity, with industrial port landholdings of 500 acres that it owns, operates, or leases. Most of this land falls within DPAs.

Major facilities both owned and operated by Massport are:

- Conley Container Terminal
- Black Falcon International Cruiseport in South Boston

Major facilities owned by Massport are:

- The Boston Fish Pier, South Boston
- East Boston Pier 1 and adjacent properties in East Boston

Facilities under lease from Massport:

- Boston Autoport, at the former Moran Terminal and Mystic River Pier One in Charlestown

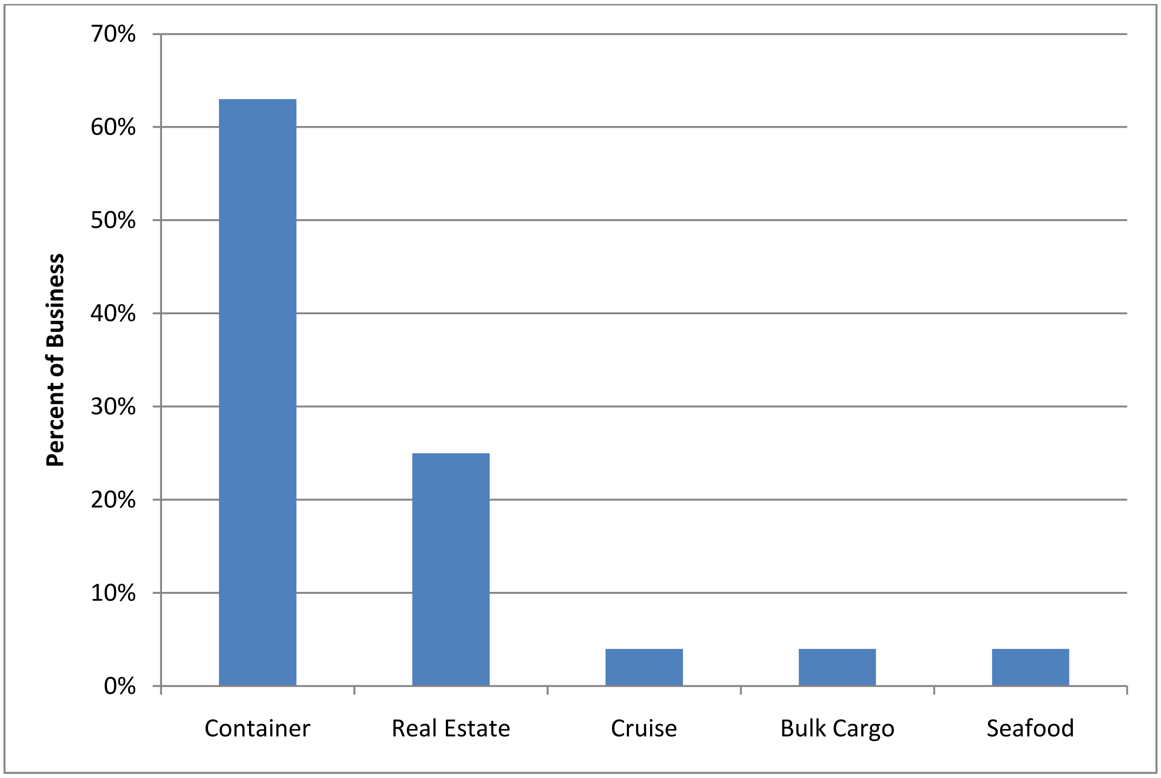
Owned by the Economic Development and Industrial Corporation (EDIC) of Boston:

- Massport Marine Terminal and adjacent North Jetty cargo facility - leased to Massport through 2070

Massport has a diverse set of key business lines (see Figure 45), including container and bulk cargo (e.g., automobiles, cement, road salt), as well as cruise and real estate operations (i.e., maritime and commercial), which allow for their cross-subsidization.[41] Combined revenues from these business lines, totaling $69 million, cover both its operating and capital expenses.

[41] Maritime Industry Trends Implications for Massport"s Maritime Operations 3/08.

Figure 45: Massport Business Lines



Source: Maritime industry Trends implications for Massport‟s Maritime Operations

The major trading areas for Massport‟s cargo operations include Europe, the Mediterranean, North and South Asia, the Middle East, and South America. In recent years, China has been its leading trading partner.

Infrastructure and Facilities

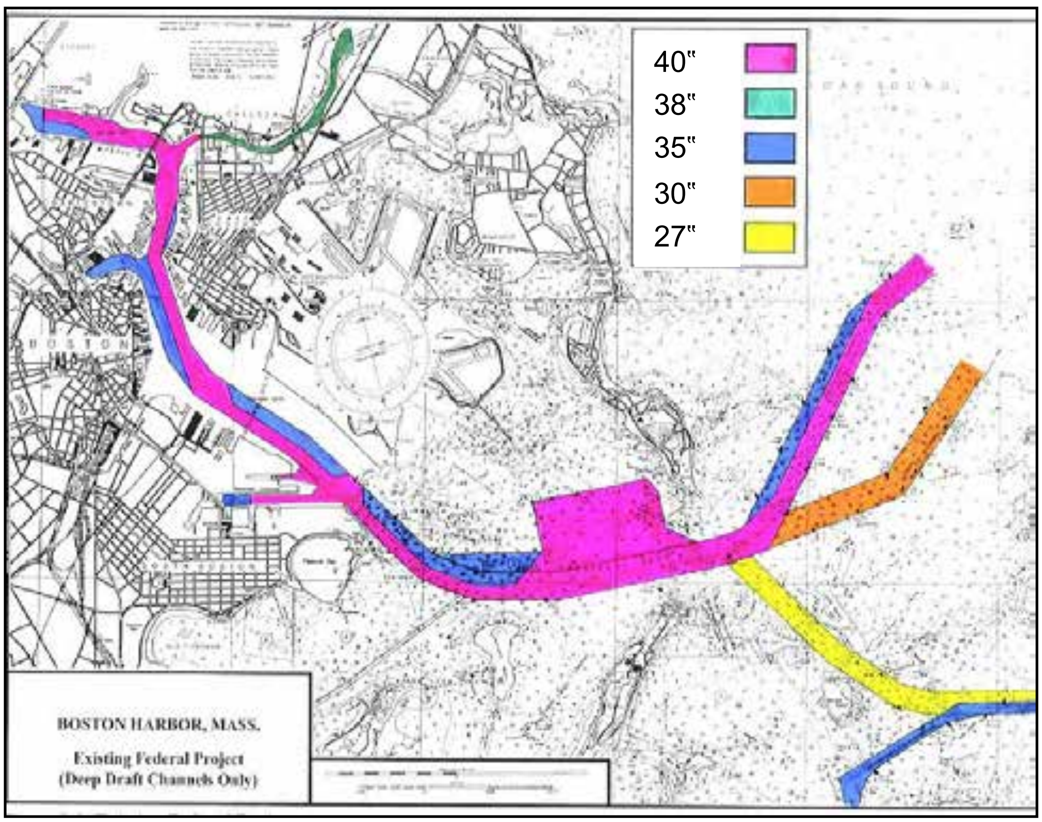
With the distance between the Port and open ocean of only four miles, Boston‟s waterside access is excellent. Boston Harbor is the largest physical harbor in New England and is well protected. While the entrance to the harbor has a number of dangers and numerous shoals and islands, it is wide, making it easy to navigate. The inner harbor is large with deepwater access. There are two dredged channels and two traffic separation schemes, which manage incoming and outgoing vessel traffic like divided highways for large ships and direct traffic to the northeast and the southwest.

The entrance is well marked by navigational aids and the entrance to the Port is close to the pilot station located in Massachusetts Bay. Boston‟s Main Ship Channel extends from the harbor entrance to the mouths of the Mystic and Chelsea Rivers and to the Charlestown Bridge on the Charles River.

The federal project channel depth is 40 feet deep from the harbor entrance to the mouth of the Mystic River, 35 feet in parts near the south side of the harbor and 35 feet north of Commonwealth Pier. There are several deep draft ship anchorages in the harbor, with the anchorage on the north side of President Roads used most frequently for ships and barges. Tidal range is around 9-9.5 feet with two highs and two lows per day. Harbor currents are generally less than one knot.

Boston‟s Main Ship Channel, providing access to Conley Container Terminal and Boston Autoport (Moran Terminal) is currently 40 feet deep. The area to the oil terminals of Chelsea Creek is 38 feet deep (see Figure 46). Highway connections from the Port‟s container facility are via a dedicated haul road connecting to I-93 South along with additional highway ramps into the South Boston waterfront area. As presented in Chapter 4, Massport is working towards a number of local roadway improvements in South Boston to facilitate highway connections. Major highway corridors relevant to the Port beyond the urban core include I-90 running west, and the Route 128/I-95 beltway. Because the majority of container freight shipments handled at the Port are destined for local and regional markets within 100 miles of Boston, most freight is delivered by truck with a very small market share for rail. The rail connection for containers is a drayage trip to the rail transfer facility at Beacon Park in Allston, four miles from Conley Container Terminal. As presented in Chapter 4, there are also plans to improve Track 61 to facilitate freight rail connections to a bulk terminal at the North Jetty.

Figure 46: Existing Federal Project (Deep Draft Channels Only)



The 101-acre Conley Container Terminal is the largest marine facility in the harbor. The terminal handled nearly 220,000 TEUs[42] in 2007, up 10 percent from 2006. The facility has 2000 linear feet of berthing with depths of between 40 and 45 feet. Terminal equipment includes four, low profile gantry cranes for vessel loading and unloading, capable of 30 moves per hour. The proximity of the container terminal to Logan Airport dictates that all cranes be

[42] Twenty-foot equivalent unit (TEU), the standard unit for measuring container volumes.

"low-profile," to meet Airport Height Restrictions.[43] The terminal can handle vessels up to an average of 5,000 TEUs, considered mid-size in the current vessel market.

Boston‟s cruise operations handled at Black Falcon Terminal are increasing. Serving New England and Canada, Boston is the predominant regional turnaround or homeport. The Port has a strong turnaround growth potential, with 13 million people within two hours of Boston and 58 million within five hours. Logan Airport, which is close to the Port and has connections to 77 US cities and 32 international cities, extends Boston‟s cruise operations‟ reach beyond the local market to virtually any other population center with air service. Black Falcon Terminal handled 280,000 passengers in 2008, and it had 116 ships scheduled with 44 turnarounds (homeport) and 72 port-of-calls. Most occurred in the fall, with 15 lines calling just in September and October.

Boston Autoport is primarily used for automobile import, processing, and distribution. It has capacity for approximately 50,000 cars per year. Its berths are weather-protected, and there is some covered storage for high-value automobiles on site in the former Mystic Pier transit shed. Other facilities not owned or operated by Massport handle 1.5 million tons of dry bulk and scrap steel cargo, along with nearly 13 million tons of petroleum products, each year.

Major petroleum product terminals in the Boston Harbor predominate along Chelsea Creek and are critical to serving the energy needs of the Northeast, as there are no oil refineries in the Boston area. Facility operators in the Port each have tanks and distribution systems.

The Port‟s private dry bulk cargo facilities manage imported goods such as salt, gypsum, cement, chewing gum, and vegetable oil. Additionally, exported goods such as scrap metal, asphalt, steel, and vehicles are also handled. Facilities are in various locations in the Port. Massport and the private sector own an assortment of seafood industry and distribution warehousing facilities in South Boston. There were 10.5 million pounds of landings of commercial fish at the Port of Boston, valued at $12.2 million in 2007; its seafood processing industry produced approximately $650 million in annual sales to regional, national, and international markets in 2001, with sales increasing further since then.

Containers represent 63 percent of Massport‟s port business by value of goods handled. Table 12 shows container cargo volumes for 2001 through 2008.

[43] Low profile cranes are constructed such that the height of the crane is lower than the aircraft clearance line and are typically only installed in locations with airport height restrictions.

Table 12: Container Cargo Volumes, 2001- 2008

Year	Import TEUS	Export TEUs	MT TEUs	Total TEUs
CY01	65,387	29,810	32,257	127,454
CY02	70,128	38,879	33,095	142,102
CY03	74,643	45,987	34,644	155,274
CY04	83,797	53,072	35,211	172,080
CY05	86,575	61,977	38,026	186,578
CY06	92,935	66,032	41,184	200,151
CY07	105,765	69,078	45,496	220,339
CY08 Jun	47,657	31,285	18,297	97,239

Market shares by port for 2006 and 2007 are presented in Table 13. The 220,339 TEU container volumes for 2007 represent an increase of 10 percent over that of 2006. Of the total containerized cargo moving by water to New England, Massport captured 30 percent of the market, a 10 percent increase since 2000.

Table 13: North America Container Port 2007 Ranking by TEU

Port	2007 Rank	2007 TEUS	Market Share 2007	2006 TEUS	Market Share 2006	Absolute Change	% Change	2006 Rank
Halifax	22	490,071	0.06	530,772	0.06	-40,701	-7.7%	21
Montreal	14	1,363,021	0.16	1,288,910	0.16	74,111	5.7%	13
Boston	30	220,339	0.03	200,113	0.02	20,226	10.1%	28
NY/NJ	3	5,299,105	0.62	5,092,806	0.62	206,299	4.1%	3
Philadelphia	27	253,492	0.03	247,211	0.03	6,281	2.5%	25
Wilmington (DE)	24	284,352	0.03	262,856	0.03	21,496	8.2%	24
Baltimore*	20	610,466	0.07	627,947	0.08	-17,481	-2.8%	20
Totals		**8,520,846**	**1.00**	**8,250,615**	**1.00**	**270,231**	**3.3%**	

Source: AAPA Survey
Notes: Baltimore data for Maryland Port Administration (MPA) facilities only. Abbreviations: TEU=twenty-foot equivalent unit; fy=fiscal year. Reported figures represent total loaded and empty containers and include those moving in domestic and foreign trade.

As shown in Table 14, Massport and private cargo values for both imports and exports increased between 2006 and 2008.

Table 14: Port of Boston (Massport & Private) Cargo Volumes ($Millions), 2005-2007[44]

Type	2008	2007	2006
Imports	$9,756	$8,723	$7,921
Exports	$1,873	$1,591	$1,292
Total Value	**$11,630**	**$10,314**	**$9,214**

[44] STAT-USA and Foreign Trade Division, US Census Bureau www.usatradeonline.gov

Issues, Constraints and Bottlenecks

Massport is working diligently to ensure that the Port of Boston remains competitive by addressing capacity constraints and other issues. For example, Massport has implemented a $28 million upgrade of Conley Container Terminal, increasing capacity without increasing waterfront land needs.

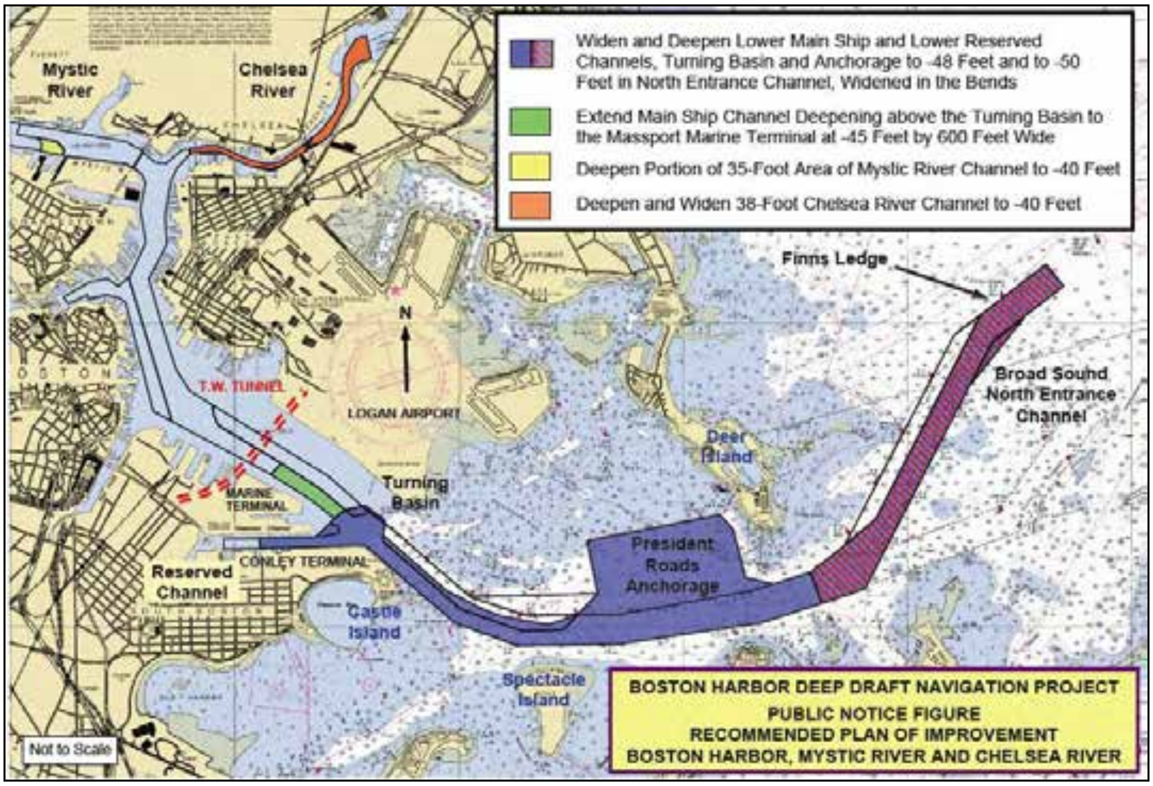
The upgrade included reconfiguring the terminal with a new layout that allows higher and wider container stacks. New equipment consisting of eight Rubber Tire Gantry cranes (RTGs) and four other pieces of onsite support equipment are also included. Shortly after completion of the upgrade, "turn-time" for trucks at the gate has averaged 36 minutes, a reduction from the average 58 minutes it previously required. Vessel productivity was reported to have increased four percent between 2005 and 2006, achieving an average of 26 container moves per crane per hour. This average approaches 30, which is the number industry sources say the Port should be moving towards to be competitive.

In addition to increasing the capacity at Conley Terminal, Massport is undertaking the acquisition of an additional 30 acres of expansion space for container handling at the Coastal Oil site adjacent to it along the Reserved Channel. In one to two years, it anticipates needing a new terminal operating system. A state-of-the-art terminal operating system today provides for automated, fully integrated and comprehensive gate, yard, and vessel operations, enhancing productivity through improved vessel planning and optimal utilization of labor, equipment, and yard space.

Waterside Access

Massport is addressing waterside access needs by providing current maintenance dredging of existing navigation channel depths. They are also meeting the longer term access needs through improvement dredging to greater depths to accommodate larger vessels. Based on a feasibility study evaluating alternatives, the Army Corps of Engineers (USACE) recommended a deeper 48-foot navigational channel access to Conley Container Terminal and 50 feet depth in the entrance channel (see Figure 47).

Figure 47: Improvement Dredging Project



Source: Boston Harbor Deep Draft DFR-SEIS-EIR – Public Notice 4-18-08

Deeper port navigational depth is important to maintain a competitive port. Since improvement dredging is costly, USACE funding support is important to financial feasibility. If the channel is not deepened, vessel delays due to the wait for tidal levels will continue to be high. This will likely cause elimination of Boston from vessel service networks that add larger ships and a cessation in the shift of cargo from PONYNJ to Boston when the limit has been reached in vessel carrying capacity for current channel depths.[45] The proposed improvement dredging project is technically feasible because most dredged material was assessed to be safe enough to be placed at the Massachusetts Bay Disposal Site.

Waterside access also affects petroleum-handling facilities along Chelsea Creek. The improvement dredging includes deepening Chelsea Creek to 40 feet to better accommodate oil tankers. The bridge at Chelsea Street presents a clearance problem for these vessels; the bridge is only 96 feet wide, limiting access to a special class of small tankers that remain in service just because they fit through the bridge. This issue is being addressed by a current construction project as part of the Accelerated Bridge Program. An agreement is in place to rebuild the bridge, and it is anticipated that construction will take three and one half years. The new bridge, which will have a 175-foot vertical clearance over the water and 220-foot horizontal clearance, will be in service in 2012. The new bridge will have a 175-foot vertical clearance over the water, and 220-foot horizontal clearance. With this new horizontal clearance, it would then be feasible to dredge the existing channel to the greater width required to accommodate larger vessels.

[45] http://www.nae.usace.army.mil/projects/ma/BHNIP/bharbor.htm

Landside Access

The primary landside access to Conley Terminal, the major container facility in Massachusetts, is via local roads connecting to the Massachusetts highway system. While direct on-dock rail can be a competitive factor for some ports, the Port of Boston"s concentration on handling freight destined for local and regional delivery within 100 miles places emphasis on having competitive highway trucking routes.

Under a recent agreement with CSX, 2nd generation double-stack trains will extend to Worcester by 2013 with bridge clearances to accommodate the increased train height. The Pan Am Railways currently supports only 1st generation double-stack trains, running from New York to Ayer, MA.

On-dock rail to Boston Marine Industrial Park and the Massport North Jetty, where the handling of bulk cargoes is anticipated, is seen as an opportunity and is being pursued. On-dock rail at this location is considered feasible through the restoration of existing Track 61 and requires protecting the easement for rail to the North Jetty. The project is in the final design stage, with a cost estimate of $9 million. This project is evaluated in the Chapter 4 investment scenario analysis.

Massport also reviewed options for restoring rail access for cargo port locations other than South Boston. In Charlestown, Massport considered the option to provide direct freight rail service for the maritime and industrial sites in the area of the Mystic River DPA along a rail right-of-way that was bought by the Commonwealth.[46] A study was conducted to evaluate the feasibility of the project, and it found that Massport"s rail property was not large enough to accommodate a rail corridor under any of the alternatives identified and evaluated. It also found that the potential for future rail use, relative to transport of different cargos in and out of Mystic River DPA, would be greatly limited as a result of additional height and weight restrictions on the regional tracks that connect to the Mystic Wharf Branch, as well as neighborhood impacts.

One of the main issues for the Mystic River DPA is the impact of truck traffic on adjacent residential areas. Attempts are being made by Massport, in its Charlestown Haul Road and Rail Corridor Feasibility Study, to address this issue in a way that is mutually beneficial to the Port and the neighborhood. Improvement in truck access between the interstate highways and Port of Boston facilities has been identified by Massport as a key issue.

Existing dedicated truck access routes do not extend to major port facilities. The level of traffic congestion in the Boston waterfront area has been growing, impacting truck access. Traffic factors include not just development growth but changes in the type of development, some the result of rezoning for uses with high traffic congestion or residential growth impacts. Conflict has developed over road usage and pedestrian safety issues. This has generated constituencies (freight and non-freight) in opposition, one side supporting dedicated truck access and the other against truck access. Massport has been taking steps to address this issue in different port locations. For example, Massport is in the process of exploring a number of alternative truck connection enhancements in South Boston. In Charlestown, Massport is working to improve landside access for industrial uses, while providing for greater separation between neighborhoods and freight-related traffic.

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[46] Boston and Maine/Guilford Rail Systems (B&M) Mystic Wharf Branch.

Environmental Impact Issues and Initiatives

Seaports are located in environmentally sensitive coastal zones. They make significant demands on the environment, through major infrastructure development in tidelands, dredged channels, and the use of pollution-producing vessels, trucks, rail, equipment, and industrial activity.

Awareness of these environmental impact issues and efforts to address them have been growing significantly for some time through coastal zone management, sustainable development, triple bottom line (i.e., social, environmental, financial), environmental report card, green port, environmental justice, and portfields initiatives. In its 2004 report, the US Environmental Protection Agency (EPA) identified four key environmental opportunities for cooperative port sector and EPA work to improve the environmental performance of seaports.[47]

The opportunities identified were in:

- Reducing air emissions;
- Improving water quality;
- Minimizing impacts of growth; and
- Promoting environmental management systems (EMS).

Also in 2004, the Natural Resource Defense Council (NRDC) produced a Port Environmental Report Card on some major US ports. The report fleshed out criteria for reducing air emissions and improving water quality, two of the areas the EPA identified as environmental opportunities. The criteria for improved air quality focused on: cleaner yard equipment and cranes; reduced emissions from ships and harbor craft; reduced truck emissions; locomotive/rail improvements; community monitoring; and alternative fuel programs. Water quality criteria included: water quality monitoring; oil spill prevention; stormwater control/treatment; and environmentally friendly dredging practices.

Massport has undertaken significant initiatives to address environmental impact issues. The Port of Boston was the subject of a case study on Environmental Management Systems in the 2004 EPA report, reflecting the efforts of Massport. The study indicated that Conley Container Terminal received ISO 14001 certification,[48] becoming the second certified US public port facility in 2003. The terminal has set EMS performance improvement objectives in eight areas: hazardous waste, wastewater, stormwater, construction waste, resource use, air emissions, spills, and noise.

In line with its commitment to conduct performance assessments, Massport issued a *Port Sustainability Progress Report* in August 2008, which discusses programs that it has undertaken to improve the environmental performance and sustainability of both its maritime operations and development of its maritime terminals and other properties in Charlestown, East Boston and South Boston.

Safety and Security

Safety and security are critical issues in port operations and are subject to federal regulations. These regulations do not introduce a competitive disadvantage for the ports, unless ports do not comply with the requirements. Such non-compliance can cause regulators to shut facilities

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[47] http://www.epa.gov/ispd/pdf/2004/portsbw.pdf
[48] ISO is the International Organization for Standardization. ISO 14001 gives the requirements for environmental management systems.

down, and facilities and their plans are checked regularly to ensure they are meeting federal regulations.

The largest Commonwealth terminal operator, Massport, has an extensive set of safety and security protocols in place that meet federal regulations. They also have a demonstrated track record of security compliance and a strong safety record.

Freight Growth Potential

Growth is projected in the container volumes handled by Conley Terminal. Massport projects four to six percent annual growth in containers (TEUs) from 2008 to 2012, and then four percent annual growth in TEUs from 2012 to 2025. This growth rate is similar to that of other ports of the North Atlantic Coastal range.

Massport data reveals that the Port of Boston‟s import/export ratio decreased between 2002 and 2006. This is relevant because a low ratio means more balanced trade, better container utilization, and therefore higher revenues for shipping lines, making a port more attractive. There may be an opportunity for Boston to further improve its ratio relative to the ports with which it competes.

Projected container demand indicates there will be capacity problems at Conley Terminal. Massport will soon be acquiring the 30-acre Coastal Oil property, adjacent to the terminal to its west, to help address the capacity issue as well as the issue of air draft restrictions limiting crane heights.[49] Massport has recommended consideration of additional acquisitions of other adjacent properties, to address both ground storage capacity and landside access issues.

Bulk Cargo

In 2007, both liquid and dry bulk cargo were down one percent at the Port of Boston. Petroleum products, the highest tonnage cargo, decreased 13 percent in that same year. Of the strong growth in tonnage at the Port of Boston between 1998 and 2004, 92 percent was concentrated in three bulk cargos: petroleum, liquefied natural gas, and salt.

World sea trade trends from 2000 to 2025 for liquid and dry bulk cargos suggest that liquid bulk cargo growth will be slow, averaging three percent over the entire period. While not growing as slowly as liquid bulk, the dry bulk growth rate projected to decrease to one percent from 2010 to 2025. Since the fall of 2008, bulk cargo has fallen precipitously with the global economic downturn. For example, total tons handled at the Port fell by 13% from 2007 to 2008 according to Massport data.

Liquid Natural Gas

The Port of Boston has one liquid natural gas terminal (LNG), Distrigas of Massachusetts LLC, (DOMAC), which is located in Everett. DOMAC‟s LNG products include both liquid and vapor forms, which it sells to the northeast region. Its customers include local gas distribution companies, electric generating facilities, natural gas marketers, and industry users. The terminal hosts two storage tanks with an aggregate capacity of 3.4 billion cubic feet, or 42 million gallons. Its installed vaporization capacity[50] is approximately one billion cubic feet per day, with a sustainable daily throughput capacity of approximately 715 million cubic feet per day.[51]

[49] Interview with Andrew Hargens, 10-7-08.
[50] Capacity for converting liquid to gas.
[51] http://www.suezenergyna.com/ourcompanies/lngna-domac.shtml

LNG shipments increased nine percent between 2005 and 2007. According to DOMAC, the Everett Marine Terminal meets approximately 20 percent of New England's current annual gas demand, and the LNG sold by DOMAC and stored in satellite facilities in New England could meet an additional 15 percent of New England's peak gas demand according to their estimates of market growth potential. Its distribution of vaporized LNG is by interconnecting facilities of two interstate natural gas pipelines, Algonquin Gas Transmission, LLC and Tennessee Gas Pipeline Company, and the local gas distribution system of Boston Gas Company d/b/a KeySpan Energy Delivery New England.

Table 15: LNG in to Everett, MA (Millions of cubic Feet (Mcf))

	2005	# Ships	2006	# Ships	2007	# Ships
Total	168,542,159	63	176,096,712	65	184,135,196	66

Source: Source: US DOE - Office of Fossil Energy

Petroleum

There are five petroleum handling facilities in the Port of Boston, two in Chelsea, one in East Boston, and two in Everett. Combined, they handled 7.7 million metric tons in 2007, 13 percent less than 2006, as shown in Table 16.

Table 16: Petroleum Products in Metric Tons

	2006	2007	% Change 2007
Port of Boston	8,876,924	7,679,205	-13%

Products include heating oil, diesel fuel, gasoline, ethanol, gasoline, jet fuel, residual oil, bunker fuels, and asphalt. Delivery to the facilities is by water, supplied by 75-120 tankers and barges annually via Chelsea Creek and additional vessels via the Mystic River. Storage capacity (2007 data) of these facilities is 5.1 million gallons. With total volume of petroleum products to MA in 2007 at 46.7 million barrels, Boston handled 90 percent of these volumes. Distribution to customers is by truck, and facility operators have cooperative agreements to ensure the product flows to customers.

Automobiles (Neo-bulk cargo)

At the Port of Boston, automobile import volumes were down nine percent between 2006 and 2007. Processed automobile volumes, however, increased approximately 73 percent from November 2006 to October 2008.

Massport has reported that a change is planned for the Autoport site that will provide for economic growth in the Port. The site is to host a 300-foot long turbine wind blade test facility and potentially a research lab on stronger blade materials. The blades, up to 230 feet in length, may be shipped in on barges for testing. This development will reduce the capacity of the site for automobile handling, but the impact will depend on future demand for this use. Current rail improvements to the CSX and PAS east-west corridors will also be evaluated for potential logistics options for this facility.

Vessel Calls

Direct vessel container service to Conley Terminal is provided by two steamship lines, Mediterranean Shipping Company (MSC), calling twice weekly from Europe and the

Mediterranean, and the China Shipping Company, calling weekly from ports in China. Two thirds of Conley Terminal container volumes are carried by these lines. Other steamship lines to other trading areas provide weekly barge service to Boston via New York.

The total number of vessel calls in 2007 was 255, an increase of 10 percent since 2006, as shown in Table 17. This is largely attributable to the new service with the UK and Europe that was being provided by the French container and transportation shipping company known as CMA CGM. This service has now been suspended.[52] The loss of the feeder service from Halifax, Nova Scotia, will decrease vessel calls in 2008. Cargo volumes have declined on the weekly barge between the PONYNJ and Boston, as a result of more competitive landside (truck and rail) rates and service frequencies from New York.

Table 17: Massport Vessel Calls by Service

Service	CY2006	CY2007	CY2008	CY2009	CY2010 thru Aug
Barge	49	49	52	51	32
CMA CGM	1	26	6	18	1
CKYH	52	51	50	49	29
Feeder	32	25	1	0	0
Misc	1	1	3	0	0
MSC E	54	54	53	56	35
MSC M	43	49	53	53	34
Total	**232**	**255**	**218**	**227**	**131**

Source: Massport
Note: The Misc moves were project cargo and RTG crane deliveries

Massport realizes the opportunity to increase its number of container carriers. While it appears that there may be opportunity in short sea shipping in the long term over long distances, issues such as union manning level requirements and distance requirements may be obstacles in the near term.

Potential Changes in Sea Trade Routes

There is good reason to believe that if manufacturing continues to shift to Southeast Asia, its path to the US will be via the Suez Canal and then to the US East Coast, increasing cargo volumes on this trade route to the North Atlantic range. It is reported that 46 percent of container exports to the US from India go through the North Atlantic range. Import growth to the North Atlantic is projected to increase faster than export growth long term, because of projected East and Southeast Asian import volumes. Imports from India will enhance this impact.[53]

To maintain its low import/export ratio and the competitive advantage this affords in this trade context, the Port of Boston will need to aggressively promote its exports" services. The commodity mix for containers imported and exported through Conley Terminal is shown in Table 18.

[52] Massport press release 3/3/09.
[53] Global Insight container market report for Massport, 2007.

Table 18: Import and Export Commodities Conley Terminal

Import Commodities	TEUs	% of Total	Export Commodities	TEUs	% of Total
Furniture	8,768	9%	Paper & Paperboard, Incl Waste	21,216	34%
Fish, Frozen	6,778	7%	Automobiles	7,116	12%
Beer & Ale	5,982	6%	Mixed Metal Scrap	4,777	8%
Still Wines	4,525	5%	Hides, Skins, Furs	3,208	5%
General Cargo, Misc	3,423	4%	Logs & Lumber	2,955	5%
Toys	3,266	4%	Foam Waste & Scrap	1,857	3%
Footwear	2,977	3%	General Cargo, Misc	1,687	3%
Plastic Prods, Misc	2,557	3%	Plastic Film & Sheet, Misc	1,299	2%
Apparels	2,537	3%	Fish, N.O.S.	1,288	2%
Spirits, Cordials	2,089	2%	Household Goods	1,183	2%
Other	50,026	54%	Other	15,140	25%
Total	**92,928**		**Total**	**61,725**	
Import TEUs for this Period	**106,447**		**Export TEUs for this Period**	**67,059**	
Difference	**15%**		**Difference**	**9%**	

Source: Massport

At Conley Terminal, there is a wide mix of commodities for imports, ranging from furniture to spirits. The most significant category of imports, however, is other. Eighteen percent of imported commodities are food and beverage. Export commodities are more concentrated, with paper products dominating at 34 percent, followed by miscellaneous shipments at 25 percent.

The strongest growth opportunities in imports are for consumer goods headed for regional markets. These include agriculture, furniture, beverages and textiles. Among exports, high-technology products such as computer peripherals and medical equipment seem likely to provide the greatest growth potential. Port stakeholders suggest there are additional export opportunities in seafood, such as mackerel, domestically and overseas.

Distribution Centers

Ports have recognized the value of consolidated distribution centers (DCs) for some time. Rotterdam was a leader in this regard in creating Distriparks and seeing these as a way to increase cargo value-added activity and not simply increase cargo volumes. Importantly, it understood how Distriparks could be a powerful incentive for choosing one port over another.

When DCs are developed in association with an array of logistics-related activities, there can be substantial agglomeration or clustering benefits. Massport understands the importance of adequate DCs, as well as the benefit of integrated, multi-jurisdictional strategies for DC development. Despite some highway trucking connections issues related to Route 2, Massport views Devens as a potential location to host DCs and the co-location of other mutually supportive activities.

A port distribution center strategy needs to be considered in light of the particulars of its specific application. There is a vast consolidation of DCs in New Jersey and Pennsylvania (Philadelphia area), a central location on the Northeast Atlantic Coast and in proximity to the region"s largest ports. These large DCs, with their economies of scale and location, serve the northeast region.

Distribution Warehouse Facilities

In 2000, 400,000 square feet of industrial distribution warehousing and related office space was opened on Massport property at 88 Black Falcon Avenue in South Boston. According to Massport, the demand for warehouse distribution space at the Port has not been met and there are numerous developable sites available where zoning allows this use. Such use is proposed at the nearby Massport Marine Terminal (MMT) projected to open in 2011, if economic conditions permit. Boston Freight Terminals, a partner in the development of the MMT, opened the International Cargo Center of New England close by on Harbor Street in 2007. Currently Boston Freight Terminals has 80,000 SF in the facility; in Phase 2, it proposes to increase this amount by 150,000 SF. Boston Freight Terminals has an existing facility at nearby 329 Northern Avenue that is currently used only for yard storage. Its plans to replace this facility with five acres of space for what is described as an integrated cross-docking and logistics management network are currently on hold, because of economic conditions. In total, Boston Freight Terminals handled more than 110 million pounds of imported cargo and 50 million pounds of exported cargo in 2006.

Based on stakeholder interviews, the question for the Port of Boston is not one of warehousing capacity, but the type of warehousing capacity. Existing capacity is limited, not so much in its aggregate amount but in the size of the units and other characteristics. Space is available, but in units too small both in footprint and ceiling height. In Boston, where real estate costs are high, density is important to cover these costs. The demand is for space with 26-foot ceilings that offer high cubic footage clear of vertical support structures, so that racking systems providing greater capacity and efficiency can be accommodated.

Table 19: Current and Proposed Distribution Warehouse Capacity in South Boston

Facility	Size	Status
88 Black Falcon Avenue (Formerly International Cargo Port) Under lease by Massport to AMB Property Corp	400k SF • Warehouse related office space • Clear ceiling height 16 F • None leased now by Boston Freight Terminals	Opened in 2000
International Cargo Center of New England 1 Harbor Street (next to Boston Freight Terminals at 329 Northern Ave) Phase 2	80k SF • Warehousing (Boston Freight Terminals) • Clear ceiling height 26 F • 150k SF (Boston Freight Terminals)	Opened April 2007 To be developed when conditions warrant
Boston Freight Terminals 329 Northern Ave	Proposed 5 acres of "warehousing"	Current use is only for yard storage; Existing buildings to be demolished; Proposed new building depends on economic conditions, currently on hold.
Massport Maritime Terminal (MMT) Fitzpatrick (Boston Freight Terminals) & Cargo Ventures chosen to develop	25-acre terminal • Proposed 400k SF industrial warehousing • (25 acres less 4.3 acres) acres bulk cargo use	2011 projected opening date, economic conditions permitting

Seafood Industry

Commercial fishing facilities for landing catch and processing seafood may be viewed as a specialized type of cargo terminal and cargo distribution warehouse or distribution centers with value-added activity. Consequently, it is important to evaluate these facilities as well.

The Fish Pier and Cardinal Medeiros Dock in South Boston are home to the Port‟s fishing fleet, where vessels are docked and fish unloaded. Seafood processing is done at a substantial and growing number of facilities in the Port. Fish and shellfish, fresh and frozen, locally caught and imported are treated in these facilities. Local transportation of fish product is largely by truck, and the impact on roads is observable. Customers include restaurants, as well as retail and wholesale seafood stores. The seafood market is not just local, however, and transport of seafood is by air as well as roadway. Transport by truck to and from the airport of this time-sensitive product contributes to local road activity. Locally caught fish volumes, while small compared to Gloucester and New Bedford, contribute to Boston‟s seafood and tourism industry.

The fishing industry is important in all of the Commonwealth‟s five major ports, except Salem, and new commercial fishing facilities have been proposed for this port. As New England‟s largest market for seafood,[54] the Port of Boston has regional significance in the industry. Massport gains four percent of its revenues from this industry. For the city as a whole, seafood processing alone produced $650 million in sales. For the Commonwealth, the industry generates $4.8 billion a year. Among fresh locally caught fish, groundfish (e.g., cod, haddock, halibut, sole) historically have been the most important fishery to Boston. While recent forecasts are that the stocks are rebuilding, the decline in this fishery has impacted Boston‟s industry significantly, reducing local supply for processors and driving the change to sourcing beyond the local market.

Massport and the City of Boston have invested in the development of seafood-processing operations at the Port, aggregated closely in South Boston. In 1997, Massport upgraded its Fish Pier operations and more recently, it has created a Seafood Processing District at the Massport Marine Terminal where eight-plus acres have been dedicated to this purpose. At this site in 2001, the Harbor Seafood Center, a modern 65,000 square foot multi-tenant seafood processing facility opened. In 2003, Legal Seafood‟s 75,000 square foot headquarters and processing operations opened. These operations are intended to complement the 67,000 square foot New Boston Seafood Center, which the City of Boston developed on adjacent land in 1997, in its Boston Marine Industrial Park. A private-sector enterprise, North Coast Seafood, opened a new 70,000 square foot processing facility nearby on Dry Dock Avenue.

Strategic Opportunities and Recommended Improvements

The Port of Boston is a key port in the New England market region. The availability of the Port as a transportation option creates competition, helping to keep rail and truck rates in check. Its economic impact is significant to the local and Massachusetts economy providing $8.7 billion in economic activity[55] and thousands of jobs. It provides an important local service center capability and has growth potential.

Massport has taken many of the steps it needs to take, and has identified others it intends to take, to enhance its competitive position and be a good urban neighbor, requirements for port sustainability. It recognizes the need to prioritize its proposed action program because of cost, limits on available funding, and the competition for this funding to meet other important needs. This prioritization is reflected in a proposed program divided into near-term and longer-term actions.

Based on the Port itself, as well as industry trends, direct calls to secondary ports are likely to continue. If borne out, this trend offers the possibility of sustained volume and/or growth in container operations at Boston when there is economic recovery. Container handling generates 63 percent of Massport‟s revenues, so actions to sustain and grow container handling need to be a priority.

Twenty-five percent of Massport‟s revenues are generated by its real estate development, both maritime and commercial, and commercial real estate development plays an important role in cross-subsidizing industrial port activities. Development can create conflict, however, by generating traffic congestion and contributing to less efficient landside transport of freight in the immediate vicinity of the Port. Such urban waterfront traffic congestion can contribute to the so-called “last mile” issues for truck freight transport between a port and the interstate highways connecting the Port to its market.

[54] *Conservation Matters*, Fall, 2001 by Rusty Russell.
[55] http://www.globmaritime.com/directory/world-ports/massachusetts-port-authority-massport.html

In the case of Boston, congestion occurs mainly between the interstate highways and Conley Container Terminal in South Boston. Massport is in the process of evaluating alternatives for providing a dedicated truck access to Conley Container Terminal. Completion of this evaluation, selection of a route and its implementation, in coordination with the City of Boston and other key stakeholders, is a strategic opportunity.

Near term strategic opportunities and recommended improvements for consideration include:

- Maintenance dredging of existing navigation depths
- Extension of existing dedicated truck access to Conley Container Terminal, as discussed previously
- Completion of the acquisition of the Coastal Oil property for expansion of container capacity
- Installation of a new container terminal operating system at Conley Terminal
- Completion of the next steps identified in the Charlestown Haul Road/Rail Corridor Feasibility Study for the haul road corridor to move forward
- Rebuilding of the Chelsea Street Bridge
- Environmental initiatives increasing energy efficiency, reducing pollution, and reducing costs; preparedness planning for exposure and vulnerability to climate change producing coastal flooding from storm surges and damage from high winds
- Aggressive promotion of export services targeting identified growth opportunities of high-technology products such as computer peripherals and medical equipment; also pursuit of identified growth opportunities in imports such as consumer goods headed for regional markets (agriculture, furniture, beverages, and textiles)
- Formulation of a strategy for development of distribution centers in coordination with the Commonwealth and reflecting market realities
- Continued support of the seafood industry, both its harvesting and fish-processing sectors, in coordination with the City of Boston
- Completion of the development program for the Massport Marine Terminal, including that for bulk cargo handling and on-dock rail

Longer-term strategic opportunities include:

- Improvement dredging per recommendations to a 48-foot depth navigational channel access to Conley Container Terminal and 50-foott depth in the entrance channel
- Development of Coastal Oil property as container terminal with new crane equipment not subject to the air-restrictions applying to Conley Terminal

2.5.2.2 Port of New Bedford

Figure 48: New Bedford Harbor

The Port of New Bedford is located on the northwestern side of Buzzard‟s Bay and is approximately 83 miles south of Boston and 166 miles north of New York. The Port, encompassing the City of New Bedford and the Town of Fairhaven (see Figure 48), is historically known for its fishing industry, but it has developed a significant break-bulk trade. The harbor, considered small geographically, is located at the mouth of the Acushnet River and has direct access to Vineyard Sound and the Atlantic Ocean. The harbor entrance is approximately 10 nautical miles from the beginning of the south entrance to the Cape Cod Canal, a major shipping route. The Port of New Bedford, as a deepwater port and with easy access to the maritime corridor along the Massachusetts coast, serves as the city‟s most significant natural resource and critical asset to sustain a healthy economy, stimulate investment, attract new industry, and create jobs. The Port supports over 4,000 jobs.

New Bedford Harbor is one of the nation's major fishing ports. Ranking first in the US in value of fish landings since 2001,[56] the commercial fishing industry generates economic activity in excess of $1 billion. The fishing fleet includes more than 500 vessels operating out of the Port. These vessels are mainly rigged for landing groundfish and scallops, high value fish. The harbor‟s seafood processing industry (25 wholesale and 35 seafood processing operations) has grown in recent years to become a nationally and internationally recognized industry center.

The Port of New Bedford supports a diverse cargo mix. It has the largest throughput tonnage of break-bulk perishable commodities in New England. The Port handles reefer (refrigerated) vessels carrying cargoes of fresh fruit, and fresh and frozen fish. Fresh fruit, primarily clementines, is imported from North Africa, and New Bedford herring product is exported.

[56] National Marine Fisheries Service.

Direct call service from Norway imports product for Massachusetts fish processors and distributors.

Each vessel load creates a $100,000-$150,000 direct impact, employing approximately 30 longshoremen for off-loading and 20 teamsters for warehouse operations. Those vessels that include export fish product cargo generate a $3 million direct annual economic impact. Each shipment brings 100-150 truckloads of product through the Port. The Port currently sees up to 25 freighters per year and is implementing a robust marketing initiative to expand import/export opportunities. In addition to reefer vessels, shipments of break-bulk cargo consisting primarily of house goods are exported to Cape Verde and Angola.

Port of New Bedford Business Lines

- Seafood industry (harvesting and processing)
- Breakbulk and bulk cargo shipping operations
- Distribution warehousing (cold storage)
  Ferry, cruise, and excursion vessel operations

Potential freight growth sectors include ferry freight to Martha‟s Vineyard and short sea shipping. The Port also serves as an important land/sea intermodal center for ferry, cruise, excursion, water taxi and other passenger operations. Ferry operations draw 120,000 passengers through the Port and cruise operations bring more than 1,500 visitors to New Bedford.

The New Bedford Harbor Development Commission (HDC) serves as the governing entity for the Port. The HDC has jurisdiction over all the waters in New Bedford and manages 20 commercial properties and the ferry terminal on the State Pier. All revenues from user fees, rents, and other sources are reinvested by the HDC to support its operations.

Much of the Port of New Bedford is in a Commonwealth DPA, regulated by Chapter 91 requirements that protect working waterfronts and set development and use standards. Multiple overlapping jurisdictions within the Port complicate local development and plan implementation. Most notably, the Port is an EPA Superfund site requiring significant clean-up of contaminants.

Infrastructure and Facilities

The Port of New Bedford is considered a moderately deep-water port with a design depth of 30 feet. The harbor is protected by a hurricane barrier that is constructed across the harbor entrance and is equipped with an opening that can be closed during hurricane conditions and severe coastal storms. The Port is considered a harbor of refuge for vessels in the region.

The hurricane barrier entrance is 150 feet wide. It opens up to a 350-foot wide channel extending to a turning basin 350 yards (1,000 feet) just above the Route 6 New Bedford-Fairhaven Bridge. The width of this bridge is 92 feet. The hurricane barrier and Route 6 Bridge widths set vessel parameters for the harbor.

Highway transport is via Interstate 195 providing direct access to Fall River, and Providence, RI, to the west, Cape Cod to the east, and to routes 140 and 24 connecting to I-95 north and the metropolitan Boston area. Route 18 runs along the waterfront and connects to I-195. Port rail access extends directly to various Port properties. CSX Rail operates freight service terminating at a railyard at the railroad depot site. The Port of New Bedford has a number of commercial cargo and fishing industry facilities on its large and small piers and wharves on waterfronts north and south of the Route 6.

Standard Times Field, one of the last major vacant waterfront sites, located on the south waterfront, has been recently redeveloped as a Marine Industrial Park intended to meet the expansion needs of the seafood processing industry. These needs were forecast at up to 230,000 square feet in the next five years. The capacity of the Marine Industrial Park is 300-500,000 SF at full build. The site, located in proximity to the fish auction on the adjacent South Terminal, was subdivided into approximately nine parcels suitable for both large and medium-sized businesses, and designed with road circulation improvements to provide access to individual parcels, to South Terminal to its north, and the main public way. To date, tenants have purchased a number of lots for development. A major incentive in attracting fishing industry tenants to the Marine Industrial Park is that it offers tenants their own docks.[57]

The adjacent New Bedford South Terminal Wharf has a 1,600-foot berth with 30 feet of depth and serves as the major offloading center for fish product. The wharf has 250,000 cubic feet of refrigerated storage, primarily used for seafood. The facility has further development capacity. The southern most portion of the facility has a potential build out capacity to host a terminal, and the site has 10 acres of backland.

Sprague Terminal, just North of South Terminal, primarily handles petroleum products. The terminal has a 740-foot berth with 27-foot depth alongside.

At the center of the Inner Harbor is the State Pier, which has three berths measuring 450 feet, 600 feet and 775 feet with 30-foot depth alongside. There is 125,000 square feet of covered storage for general cargo, and shipping operations include break-bulk cargo service to Cape Verde and Angola. Only the cruise and ferry service to Cuttyhunk Island includes freight transport. The terminal has roll on-roll off capability via a ramp that is 100 feet long and 18 feet wide and will hold up to 200 tons; water depth at the ramp is 27 feet. The State Pier was the location of a two-year pilot program for a temporary barge freight service to Martha"s Vineyard (Quick Start Ferry operation). The proposed site for a permanent operational facility was north of the Route 6 Bridge at a location that also had rail connections. Because the bridge widths were too small to accommodate the size vessels to be used it was proposed that the bridge be relocated north of the proposed permanent ferry site, but the trial program did not become permanent.[58] On the waterfront north of the Route 6 Bridge are Maritime, Bridge, and North Terminals, described in Table 20.

[57] Interview with John Sackton, Editor/Publisher, Seafood.com, 12-10-08.
[58] Interview with Roland Hebert, SRPEDD, by phone 12-10-08.

Table 20: Inner Harbor Facilities

South of Route 6 Bridge	North of Route 6 Bridge
MARINE INDUSTRIAL PARK (formerly Standard Times Field) • 300-500,000 SF at full build, expansion site for fish processing	MARITIME TERMINAL • Berthing Space: 600‟ (183 meters) • Pier draft: 30‟ (9 meters) • Dock height at mean low water: approx. 15‟ (4.5 meters) • Now takes foreign freighter • 3 million cubic feet refrigerated storage
SOUTH TERMINAL (Future Site) • Berthing Space: 1600‟ (121 meters) • Pier Draft: Dredge to 30‟ • 250,000 cubic feet of refrigerated storage primarily used for seafood • 10 acres backland	NORTH TERMINAL AND WHARF Existing • Bulkhead – 580 F • Bulkhead Draft: 25 F • 63,400 SF refrigerated storage • 57,500 SF freezer space • 34,700 SF covered storage warehouse space • 25 acres of land (EPA Dewatering Facility – Future Development Site expanded to include above 25 acres) Currently • 2-acre terminal • Berthing Space: 205' (62.5 meters) Future Pier Draft: 30 F
SPRAQUE TERMINAL • Berthing Space: 740' (226 meters) • Pier Draft: 27' (8.22 meters) • Imports Home Heating Fuel	BRIDGE TERMINAL • Berthing Space: 450' • Pier Draft: 28' (9 meters) • 500,00-cubic foot refrigerator warehouse handling frozen and chilled food products3 million cubic feet refrigerated storage 25 vessels/yr, transporting 1500-4000 tons fish or 2000-3000 tons fruit
STATE PIER Harbor depth: 30′ (9 meters) Berthing – Max. length overall 775′ Max. ship beam allowable 70′ (21 meters) Max. draft allowable 27′ (8.22 meters) RoRo – ramp 100 F length 125,000 SF covered storage 135 container storage capacity Breakbulk shipping operation to Cape Verde and Angola Cruise, ferry operations	

Figure 49: New Bedford Fairhaven Master Plan Map

A two-acre terminal site is expected to come on-line over the next five years. This facility is currently operated by the EPA as part of the superfund clean up of the contaminated sediments of New Bedford Harbor. New developable waterfront land is being made from dredged materials. The facility has rail connections that lead directly to the water‟s edge; in fact, rail is used to transport dredged materials to be disposed at landside sites in out-of-state locations. Upon completion of cleanup activity, the site will revert back to the City. It is to be reused as a ferry/marine terminal and to be expanded to a 25-acre property, linked to a new multi-modal transportation facility being developed on an adjacent site, and will have 30-foot deep-water draft to accommodate freight vessels waterside.

Adjacent to the North Terminal area to its west, and running along Route 18‟s northbound lane, is the 30-acre Railroad Depot site. The site is in the process of transformation to an intermodal, multi-user facility. Construction started in 2002 and when completed, it is planned to host a commuter rail station with layover tracks, a freight railyard, freight forwarding businesses, parking, as well as retail space and bus service. The New Bedford Rail Yard, already completed, has enabled transfer by rail of contaminated dredged material from the EPA dewatering facility, as discussed above. The rail transfer operation began in the fall of 2005.

The Port is a full service port, and associated maritime industries include vessel maintenance and repair conducted at dockside or at repair facilities in New Bedford or in Fairhaven. The Port has two moderate size shipyards, as well as over 75 businesses to support commercial and recreational vessels and maritime industries, providing ice, fuel, oils, electronics, and other products.

According to US Army Corps of Engineer data, total waterborne freight volumes for the Port of New Bedford in 2006 were 599,000 short tons, a reduction to levels last seen in the late 1990s. As channel maintenance dredging, which allowed for waterborne freight transport in the harbor for the first time in many years, began in 2005 and was completed in 2006, the data may not encompass its impact. The 2-year Quick-Start Ferry carrying freight to Martha"s Vineyard began operations in 2001 and volumes increased to 963,000 short tons in 2002, the highest for the period between 1997 and 2006. Leading commodities in 2006 were sand and gravel, petroleum products; food and farm products, including fish, and gypsum and steel scrap.

Issues, Constraints and Bottlenecks

While on-going dredging has restored main navigation channel depths in some locations, design depth is limited to 30 feet, the turning basin can only handle small cargo ships, and completion of maintenance dredging of the federal channel and turning basin,[59] will take 5-9 years. With maintenance dredging completed on the main channel, New Bedford qualifies as a medium deep-water port. The Route 6 Bridge limits the size vessel that can access the north terminal portion of the harbor, and having an outmoded swing bridge causes delays in travel time. There is excellent interstate highway access nearby but problems in connecting from the interstates to the port area, a last-mile issue. Congestion occurs on Route 18, which runs along the waterfront and connects to I-195. The Route 18/JFK Highway Access Improvement Project has been proposed to improve last-mile truck access to waterfront industries, as well as the connection between the downtown area and the New Bedford waterfront. While rail access extends directly to various Port properties, problems with the tracks limit speed, as do three structurally deficient bridges carrying trains – planned for reconstruction using Transportation Investment Generating Economic Recovery (TIGER) funds.

Some of the most critical infrastructure in the Port is aging and in need of repairs and improvements. The leading Port industry, fishing, is facing additional regulations, which are expected to have an adverse impact on the number of fishing vessels using the Port.

Operations

Figures below show that New Bedford has a record of being the top ranking port in the country in the value of commercial fish landings. Its dominance in the high-value scallop fishery contributes to this status. Expansion into other fisheries has made up declines in groundfish landings; for example, mackerel that has been in abundance presented an opportunity, which was capitalized upon. Among Atlantic coast ports, New Bedford was first in volumes and second in value in mackerel landings (see chart in section on Port of Gloucester).

When groundfish stocks have rebuilt, as they are projected to do and some species have already done, New Bedford stands to significantly increase its landings in this fishery. A seafood industry expert has indicated that New Bedford should have no capacity problems with regard to the harvesting or processing sectors of the fishing industry.[60]

[59] If the city can provide water traffic projections that demonstrate its need.
[60] Interview with John Sackton, Seafood.com, 12-10-08.

Table 21: Commercial Fishery Landings New Bedford Port

Year	Rank	lbs in Millions	$ in Millions
2000	1	89.9	148.8
2001	1	107.2	151.4
2002	1	108.7	168.6
2003	1	155.5	176.2
2004	1	175.4	207.7
2005	1	153.4	282.5
2006	1	168.3	281.4
2007	1	149.5	268.0

Source: http://www.st.nmfs.noaa.gov/pls/webpls/MF_LPORT_YEARD.RESULTS

Environmental Impact Issues and Initiatives

The major environmental issue for the Port is New Bedford Harbor‟s Superfund status, and its impacts on dredging. The harbor has been challenged by a significant pollution problem from local industries, which up until the 1970s discharged wastes containing polychlorinated biphenyls (PCBs) and toxic metals into New Bedford Harbor. This resulted in high levels of contamination throughout the waters and sediments of the Harbor and extending into Buzzards Bay, leading the EPA to declare New Bedford Harbor as a Superfund Site. Since 2004, the EPA has been dredging to remove the PCBs through a complex process to deal with contaminated sediments. The EPA is employing technologies, such as confined aquatic disposal, that create new waterfront land. As noted above, upon completion of the clean-up activity, the new land will come under city control and open new waterfront parcels up for development.

New Bedford was one of a few ports in the nation to participate in a federal pilot program on portfields – Brownfield port sites. As part of this program, New Bedford initiated a streamlined permitting regiment for dredge projects that resulted in expedited maintenance dredging on the inner harbor. Under the initiative, dredging of Commonwealth and federal resources for nearly two million cubic yards of material came under a streamlined regulatory process. The result was the increasing of water depths of the Port of New Bedford to levels such that freighters for the first time in 50 years began navigating the harbor.[61]

Hurricanes represent a significant risk to port economic assets and the environment. The New Bedford Hurricane Barrier has been an important factor in managing this risk. According to the city‟s web site, the Hurricane Barrier protects approximately 1,400 acres of industrially- and commercially-developed properties from New Bedford Harbor to Clark‟s Cove, including the fishing fleet in the Inner Harbor.

Safety and Security

Safety and security are critical issues in port operations. The smaller ports are advised to mirror some of the protocols that are already in place at Massport, as their activities develop or increase. Smaller terminals that handle international commerce were not found to have any safety or security issues that created a barrier to commerce.

The Commonwealth, through the Seaport Advisory Council and Executive Office of Public Safety & Security, with the benefit of federal funds, has helped the smaller ports of the

[61] http://www.ci.new-bedford.ma.us/PortofNewBedford/AboutPort/Future.html

Commonwealth. Over $500,000 in federal grants has been received to date to enhance security controls at these ports. A grant was dedicated to the assessment of their physical risk, identifying port vulnerabilities, recommending mitigation measures, and serving as a tool to assist in the development of federally required facility security plans for the State Pier facilities in New Bedford, Fall River, and Gloucester. Preparation of the required facility plans, as well as mandated training, was undertaken through additional Massachusetts funding support. The findings of the risk assessment were used as the basis for improving port security access controls at the Commonwealth pier facilities.[62]

Freight Growth Potential

The Port has many advantages. It is well protected by the Hurricane Barrier and has support mechanisms in place for commercial vessel activity. Capacity in the seafood industry (harvesting and processing) and breakbulk perishable cargo operations is extensive. Warehouse and cold storage capacity is also significant and there is an established distribution system operating out of the Port. While in need of improvements through undertaking identified projects or completing projects in various stages of development, the Port has good land – and waterside access and it has available land to accommodate new freight terminal facilities. For example, there are opportunities for expanded maritime industrial development in North Terminal/Mills Harbor area. Seizing these opportunities will become more feasible once improvements are made to the Route 6 Bridge that allow access of larger vessels to the area and reduce transport delays landside and waterside with bridge openings and closings.

The Port has a foreign trade zone (FTZ), which is particularly important to the sustainability of freight operations and the potential for new growth. Goods in the FTZ can be assembled, manufactured or processed and final products re-exported without paying Customs duties. If the final products enter the US, the duty rate may be lower than the duty applicable to the product itself or its parts. Ports with an FTZ benefit competitively because they offer foreign businesses looking to trade in US markets a potential cost advantage.

New Bedford‟s FTZ is able to sponsor expanded general-purpose sites within a 60-mile radius of the city. In addition, the FTZ has the potential to sponsor qualified subzones anywhere in Massachusetts. By establishing a subzone, international businesses can reduce operational costs by categorizing imports and exports so that goods are taxed at the least cumbersome stage in the chain of distribution.

The main areas for freight-related growth include fish processing, expanded freight handling, and coastal (short sea) shipping.

Economic Development and Land/Water Use

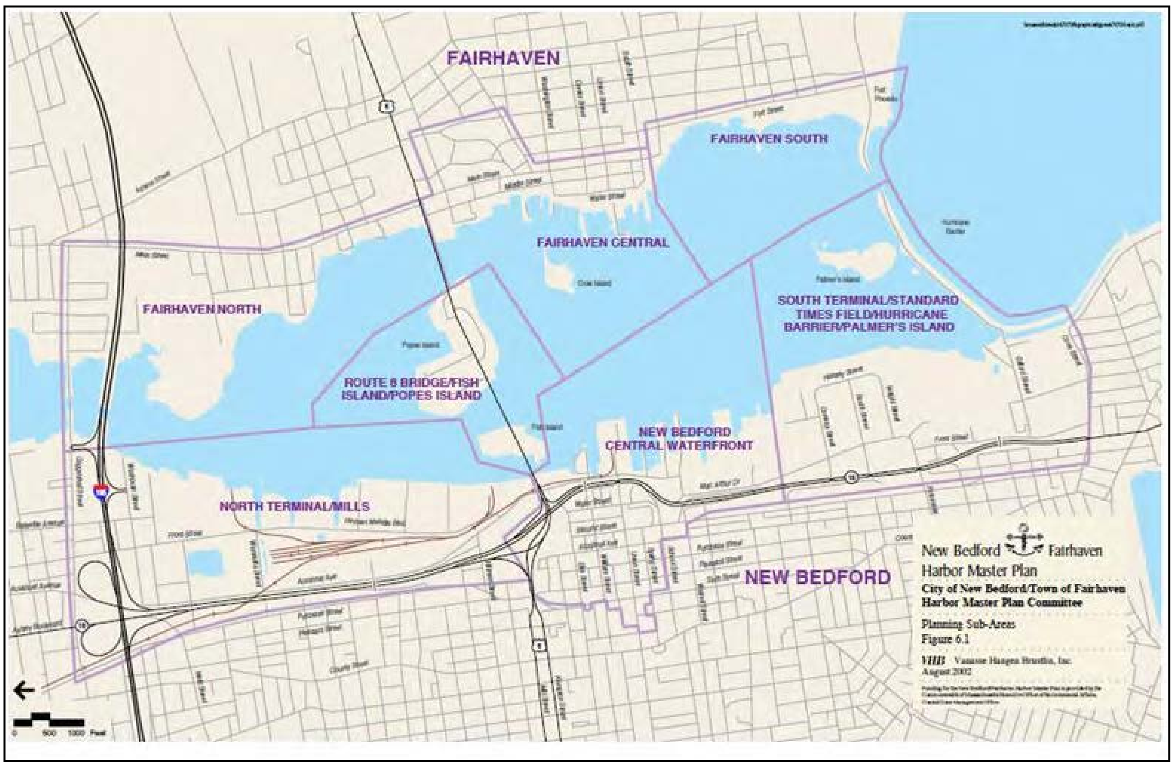
In addition to the impacts of the harbor contamination, its Superfund site status, and resulting delays in maintenance dredging, development opportunities have been stymied because of conflicting local views about the Port‟s future development. Locals debate whether it should be a more tourist and recreational port or an industrial port with a continuation of traditional activities such as fishing and shipping operations or potential new industrial port activities. Reconciling conflicting local views had to incorporate multiple overlapping Commonwealth and federal jurisdictions, the Harbor‟s DPA status, and its Superfund status.

[62] MA Seaport Advisory Council Web site http://www.mass.gov/?pageID=gov3subtopic&L=5&L0=Home&L1=Our+Team&L2=Lieutenant+Governor+Timothy+P.+Murray&L3=Councils&L4=Seaport+Advisory+Council&sid=Agov3

The Master Plan‟s proposed sub-areas, as shown on Figure 50, have the following land use goals:

- **New Bedford Central Waterfront –** Major uses include city-owned fishing piers, the State Pier operated by DEM, the former Commonwealth Gas and Electric site proposed for aquarium development, and portions of the downtown area.
- **New Bedford North Terminal/Mills Area –** Major uses include mill complexes, fish processing facilities, marine terminals including Maritime Terminal, and the former rail yards that will serve as the future New Bedford Intermodal Transportation Center
- **New Bedford South Terminal/Standard Times Field/Hurricane Barrier/Palmer‘s Island –** Major uses include seafood processing and general industrial uses in South Terminal, undeveloped land area at Standard Times Field, and the Berkshire Hathaway Mill complex
- **Route 6 Bridge/Fish Island/Pope‘s Island –** Major uses include marine terminals and marine industrial uses, retail, and the Pope‟s Island Marina

Figure 50: Proposed Sub-Areas According to Master Plan

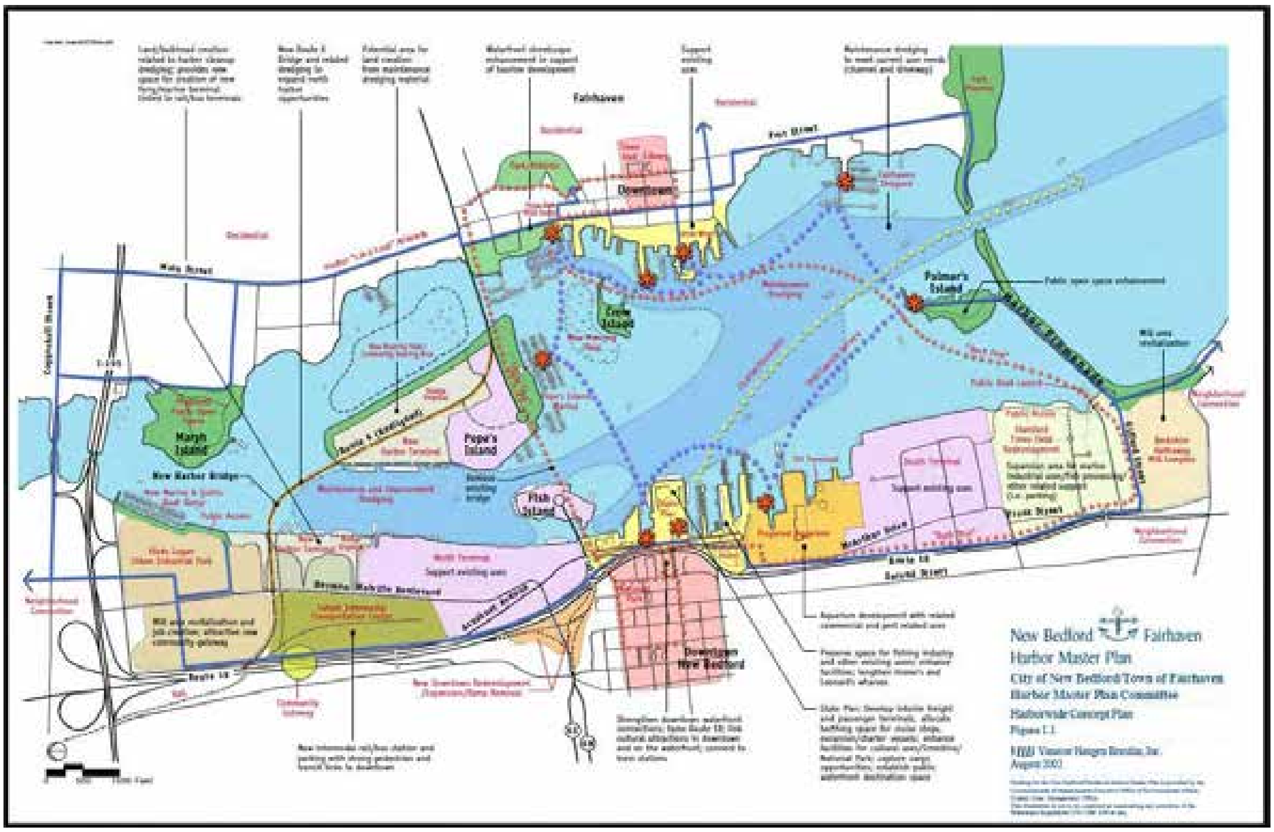


This became the basis for the Harbor Plan as shown in the Harbor Wide Concept Plan, Figure 51 below. As the figure illustrates, recreational and tourist uses are concentrated in the Central Waterfront area. Commonwealth approval of the plan meant this was done in a way that met DPA regulatory requirements.

Agreement on a Commonwealth-approved plan enhances development opportunity, sending a positive signal to the development community, and providing for a potentially more streamlined development process. The 2002 plan promotes opportunity for industrial port uses in locations that capitalize and build upon the Port‟s freight-related assets. Projects in the plan include the development of the intermodal transportation facility linked to the ferry/marine terminal as re-use of an EPA harbor clean-up site.

A draft updated Harbor Plan was released in March 2009. No longer calling for relocation of the Route 6 Bridge, the New Bedford and Fairhaven communities now seek a bridge in its present alignment with an opening 150-feet wide, commensurate with the width of the opening of the Hurricane Barrier. Approval has been granted to proceed with necessary environmental studies.[63] While engineering and design for the bridge replacement can be completed in five years, project completion is expected to take ten years, with funding availability the determining factor.

Figure 51: Harbor Wide Concept Plan



[63] Interview with Roland Hebert, SRPEDD, 12-10-08.

Strategic Opportunities and Recommended Improvements

Strategic opportunities coincide with many of the recommendations made in the most recent Southeastern Regional Planning & Economic Development District (SRPEDD) Transportation Plan. They also include port priorities expressed at the Focus Group Meeting held as part of the Port Professionals meeting in August 2008.

New Bedford‟s large fish processing capacity, its closeness to the New England fishing grounds, and leading position in landing high value species have maintained the seafood industry as an important economic generator for the community. Enhanced effectiveness in transportation systems in ways identified by New Bedford plans would help to sustain and provide the potential opportunity for market growth.

Short sea shipping holds opportunity for New Bedford. At this time, the city is completing an economic development plan that will include determining the economic feasibility of coastal shipping and will be used as the basis for its decision-making. The 2009 draft Harbor Plan calls for development of a prototype short-sea-shipping operation with connections to one or more East Coast ports, including appropriate infrastructure to support this initiative in the mid-term, between 2011 and 2013. Multiple consultant studies have been undertaken previously that support the finding that there is opportunity in New Bedford. One study has pointed to a specific site in the South Terminal/Marine Industrial Park area (formerly Standard Times Field) as a feasible location for a coastal shipping service between Richmond, Virginia, and New Bedford, involving 84 trips per year carrying 100 trailers and containers on each trip.[64]

There are other indications that coastal shipping is viable in New Bedford and Fall River, including: substantial truck volumes that move along the North Atlantic coast with origins and destination in the hinterland of these ports; shippers‟ increasing awareness of coastal shipping and that it presents an opportunity for them; the economics of coastal shipping that seem competitive with alternative modes, particularly on long hauls if “best in class” practices can be used in terms of vessel costs, labor levels, and stevedoring operations, enabling the full potential of coastal shipping cost and service efficiency; and, the reality that primary competitors, major ports in RI, are a greater distance from the central and northern New England hinterland.

There are capacity limitations at the port‟s terminals that require attention if there is to be success. In New Bedford, berth and yard capacity would need to be improved to enable coastal shipping at current cargo facilities. There has been discussion related to expanding the South Terminal to accommodate future short sea shipping, but moving these plans forward is contingent upon economic conditions and the acceleration of the EPA superfund clean up. At the moment, there are no official plans, funding or customers in place, but New Bedford is interested in the development of plans to improve South Terminal.

If located at the North Terminal, a roll-on/roll-off (RoRo) berth and adequate access by reconstruction or relocation of the Route 6 Bridge would be needed to be competitive on cost and efficiency with other ports and modes. Factors that add to the cost of coastal shipping, such as the relatively high cost of commercial vessels built by US shipyards, would also need to

[64] TEC Inc.

be addressed.[65] This high cost is due to the Jones Act, which requires that coastal shipping with origins and destinations in the US be conducted by US-built ships.

The Port also has the potential to re-establish a permanent location for freight ferry service with Martha‟s Vineyard and initiate other island freight trade. In addition to expanding the Port‟s shipping activity and meeting cargo distribution needs, this project has the potential to reduce regional truck traffic, as was demonstrated by the pilot 2-year Quick Start Ferry project.

The following are the recommended improvements for consideration based on the Port plan and industry research:

Nearer Term (2010-2013):

- Needed improvements to maritime infrastructure including bulkheads, piers, and wharves.
- Development of prototype short-sea-shipping operation with connections to one or more East Coast ports including appropriate infrastructure to support this initiative.
- Last mile improvements to be undertaken as part of the Route 18/JFK Highway Access Improvement Project.
- North Harbor/North Terminal Study, including port marketing and facilities development strategies, bridge relocation and infrastructure improvements.
- Development of staging areas for trucks vital to the ability to capitalize on new coastal shipping and freighter feeder service opportunities.
- Equipment and shore side power for terminal facilities (State Pier and North Terminal site), in particular, a versatile mobile harbor crane and ground support equipment. This investment is on the region‟s transportation improvement program (TIP). The installation of shore side power to support cargo and cruise vessels would both reduce emissions and increase energy-efficiency.

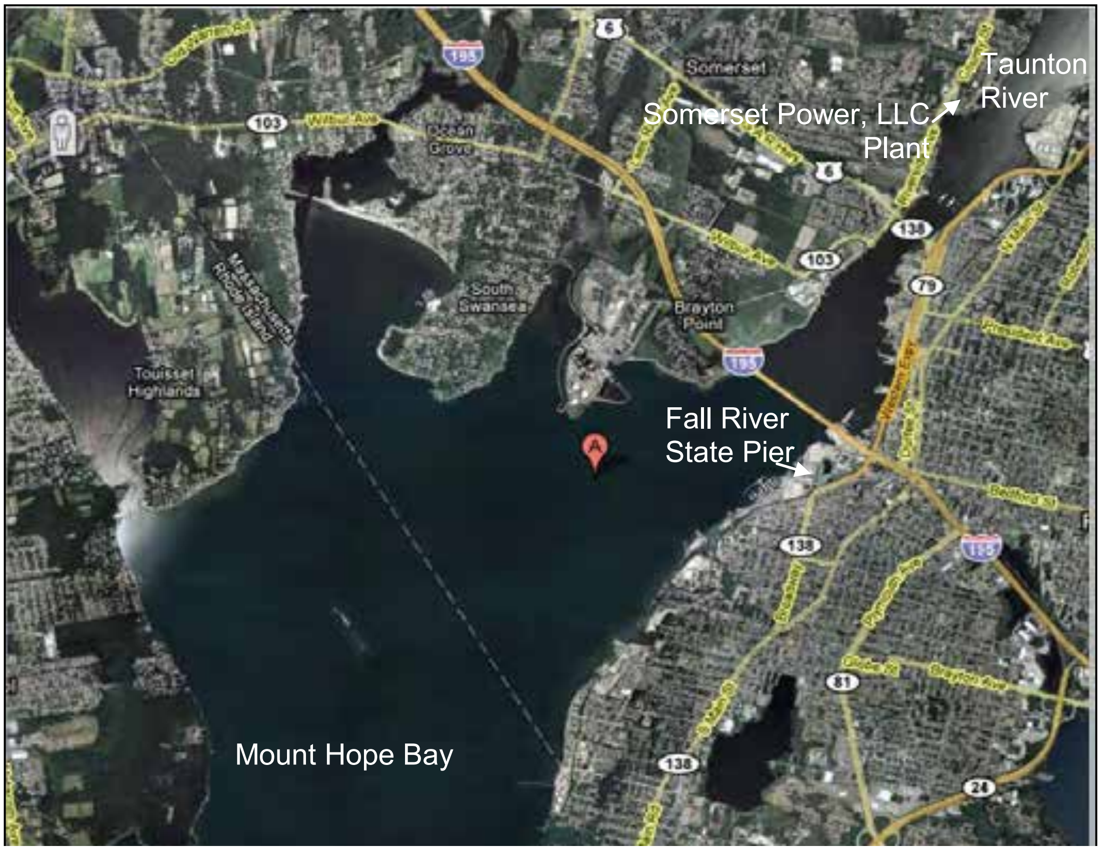
Longer Term:

- Capacity improvements needed to accommodate coastal shipping, including berth and yard capacity improvements, if at current facilities of south/central waterfront.
- Replacement of the Route 6 Bridge critical to the passage of vessels to North Terminal and maximizing the Port‟s potential for trade.
- A RoRo berth and adequate access by reconstruction or relocation of the Route 6 Bridge if on north waterfront.
- Development of the 25-acre site north waterfront site, currently used in part as the EPA dewatering facility. Improvements should provide for handling of various cargo types including containers, project cargo, neo-bulk and dry bulk cargoes.
- Completion of remaining phases of the dredging project, including the maintenance dredging of the federal navigation channel project, to improve cargo and fishing vessel navigational access, and berthing and turning basin capacity to accommodate higher-tonnage vessels.
- Rail trackage and bridge improvements to increase transport safety and efficiency and accommodate increased cargo shipments, making rail more competitive.

[65] Analysis of the Potential Market for Short Sea Shipping Services over the Ports of Fall River and New Bedford, Reeve & Associates with: Global Insight, KKO and Associates, 3/2006.

Port of Fall River

The Port of Fall River is located at the mouth of the Taunton River at the head of Mount Hope Bay, at the northeast side of Narragansett Bay near the Massachusetts-Rhode Island border. The Port is approximately 18 nautical miles from the south entrance of Narragansett Bay, which flows into Rhode Island Sound, and 17 miles west of the Cape Cod Canal. Fall River is approximately 90 nautical miles south of Boston and 150 nautical miles north of New York. By land, it is located about 46 miles south of Boston, 16 miles southeast of Providence, RI, and 12 miles west of New Bedford.



The Port encompasses the waterfronts of Fall River on the east side of the Taunton River and Somerset, MA, on the west side of the river.

The Port is historically known for its manufacturing and distribution and has developed a small break-bulk trade. Major facilities in Fall River include a state pier and commodity chemical manufacturing plant with terminal facilities for liquid latex and other chemical deliveries.

Cargo operations at the Fall River State Pier have included handling mostly container and break-bulk cargos, vehicles, heavy equipment, chemicals, and fresh and frozen seafood. Current container and breakbulk cargo comes primarily from the Cape Verde Islands, and vehicles and equipment from Angola. Frozen fish, totaling approximately 750 tons per year, is handled at a fish-processing vessel permanently moored at the State Pier. In Somerset, facilities include two power plants with maritime terminals for fuel deliveries of coal, natural gas, and oil.

The main access to the Port from the shipping lanes of the Atlantic Ocean is through Narragansett Bay, to Mount Hope Bay, up the Taunton River. Tidal currents are generally not a problem for navigation. The mean range of the tide is around 4.5 feet at Fall River. The Port has US Customs Port of Entry capability through New Bedford. Tug services are available in the Port, and from Providence, RI. There are some repair services but no dry-docking capability. There are two small shipyards in the Port on the west side of the harbor.

Infrastructure and Facilities[66]

Considered a medium deep-water harbor, it is seven miles long with a 35-foot deep federal channel through Mount Hope Bay, ending about one mile above the Brightman Street Bridge. The harbor has no designated anchorages.

There are two bridges that cross the Taunton River at the Port. They include the Braga (I-195) Bridge, a fixed bridge, at the State Pier with an air draft clearance of 135 feet. The second, the Brightman Street (Route 6/138) Bridge, is a bascule style bridge with a 60-foot clearance about 1.3 miles above the Braga Bridge.

The Port has good highway access and is served by US Route 79 to Route 24, north to Interstate 95 to the metropolitan Boston area, Interstate 195 connecting to Providence, RI, to the west and Cape Cod to the east, and Routes 6 and 138. There are freight rail activities through CSX Rail connecting to the State Pier and several industrial sites in Fall River.

In addition to freight activities, there are several cruise ship visits each year and a number of recreational vessels activities supported by marina facilities at several locations.

Port of Fall River

Business Lines	**Commodities**
State Pier	
• Container/breakbulk shipping operations	Vehicles, heavy equip.
○ Secondary marine uses	Fresh, frozen fish
○ Seafood industry (harvesting, processing)	
• Marine Construction	
• Ferry, cruise, and excursion vessel operations	
Broader Port Areas	
• Commodity chem. manuf.	Chemicals, latex
• Power plants	Coal, petroleum prod.

The Fall River State Pier is the one public facility of the Port. It is located at the mouth of the Taunton River at the site of the former Fall River Line Pier, which was a major steamship operator in New England in the past. The Braga Bridge carrying Route I-195 crosses overhead. The Commonwealth-owned general marine terminal provides two deep-water berths, a 550-foot berth with 30 to 35 feet depth alongside, and a 400-foot berth (capable of accommodating a 600-foot vessel) with 35-foot depth alongside. There is also a 96,000 square foot (1.53 million cubic foot) shed providing covered storage, as well as 100,000 SF of open storage yards. The terminal is equipped with a roll-on/roll-off facility with an 80-foot ramp. It also has a 100,000-lb truck scale. There are three rail spurs that provide direct on-dock rail connections, although only one is operable.

[66] http://www.weaverscove.com/files/2008_7_8_Weaver's_Cove_Ad.pdf for expansive view of port facilities.

Adjacent to the State Pier to its north is the USS Massachusetts Battleship Memorial where there are a number of former naval vessels berth, open to the public. Neighboring the State Pier to its south is the 26-acre Borden Remington Corporation plant site (previously the Tillotson Complex). Its wharf is 380 feet long with 28-foot depth alongside, and vessels carrying liquid latex cargo to the plant currently average five vessel calls annually.

Two miles north of the State Pier is the site of the former Shell Oil Company Terminal and Wharf, now owned by Weaver"s Cove Energy. The Wharf has a 700-foot berth with 30-foot depth alongside. Weaver"s Cove Energy proposed this site as the location for a LNG facility that was approved by the Federal Energy Regulatory Commission in 2006.[67] A rehearing on the facility was granted in August 2008 and is ongoing.

On the west side of the Taunton River, in Somerset, MA, is the Brayton Point Power Station served by a dock, which has a 1,017-foot berth with 34-foot depth alongside. The facility, designed to handle coal, natural gas, and oil, is owned by Dominion Energy. Capable of generating up to 1,599 megawatts (MW) of electricity, it is currently New England's largest fossil-fueled power plant.[68] According to a recent press release, Dominion is investing $1 billion to keep Brayton Point in compliance with new regulations aimed at reducing greenhouse gas emissions.

Somerset Power Plant, owned by NRG Energy, is located north of the Route 6/138 Brightman Street Bridge. It owns and operates a wharf with a 645 foot berth and an alongside depth of 34 feet used for deliveries of coal and oil, which fuel the plant. The plant has a capacity of about 120 MW and is reportedly converting to plasma gasification.

As shown in Table 22, trends in maritime cargo operations at the State Pier have been dynamic, with business activity moving up and down in recent years. Total Fall River cargo volumes grew from 2005 to 2006 and then decreased to 2.3 tons by 2007. Nearly 95 percent of the cargo volume was coal, based on US Army Corps of Engineers data.

Table 22: Fall River Cargo Volumes and Values

Cargo Type	2007	2006	2005
Imports ($)	$118,663,500	$138,819,889	$139,993,812
Imports (tons)	2,294,920	2,550,784	2,373,706
Exports ($)	$876,257	$2,023,764	$1,481,940
Exports (tons)	636	626	429
Total Value	$119,539,757	$140,843,653	$141,475,752
Total Volume (tons)	2,295,556	2,551,410	2,374,135

Issues, Constraints and Bottlenecks

The Port is supported by good landside access, both road and rail, and it has cargo storage and handling capacity. Vessel draft of the main shipping channel, however, is limited to a 35-foot overall depth, and the State Pier can only handle small cargo ships. The warehouse space at

[67] http://www.weaverscove.com/proposal.html: Weaver's Cove Energy [proposed] to build a liquefied natural gas (LNG) receiving terminal on the Taunton River in the North End of Fall River, Massachusetts. [The] facility was to consist of a single storage tank, a new pier, various processing equipment and several small support buildings. As an alternative, Weaver"s Cove Energy [proposed] to construct an offshore berth in Mount Hope Bay.
[68] SRPEDD Transportation Plan.

the terminal is unheated, provides only temporary storage, and does not currently provide any cold storage. Some of the terminal and berth infrastructure in the Port is aging and in need of repairs and improvements.

To accommodate the limited size vessels that can navigate the main channel, dredging is needed to maintain its 35-foot depths. The Somerset Power Plant also needs maintenance dredging of its 34-foot vessel-berthing basin and in a second area to 17-feet, to prevent the intake of sediments at the cooling water intake. The Port‟s expansion of shipping is also hindered by issues around gentrification and a focus on tourism-based activities on the Fall River waterfront.

The State Pier and other properties fall within a Commonwealth DPA requiring preservation of port uses, but allowing some flexibility to accommodate commercial activity if it economically or operationally supports industrial port uses. While a consensus has been reached on the use of the State Pier, the proposal for developing an LNG import facility has been met with significant local opposition.

Environmental Impacts and Initiatives

Environmental impact issues have been raised about both power plants in the Port. Brayton Power Plant has been cited as the largest single source of air pollution in Rhode Island, with three of its four units fueled by low sulfur coal. There have also been issues concerning its mercury emissions and the impact on Mount Hope Bay‟s marine life from the temperature of its discharge waters. Commonwealth and federal environmental agencies have stepped in – MA DEP in 2003 with a schedule for implementing regulations to reduce air pollution emissions and the US EPA in 2006 to reduce water use and discharge temperatures. As noted above, Dominion Energy has committed to investing a significant sum to ensure compliance with regulatory standards.[69]

The Somerset Power Plant, also coal-fired, was subject to MA DEP regulations making its continued operation after 2010 dependent on its switching to the use of fuels with cleaner emissions. In 2007, it granted the plant owner, NRG Energy, permission to install a Plasma Gasification reactor system and in 2008 the required final air permit. Environmental groups have opposed the conversion to plasma gasification arguing that it would increase greenhouse emissions among other environmental impacts.[70]

Safety and Security

Safety and security are critical issues in port operations. The smaller ports are advised to mirror some of the protocols that are already in place at Massport, as their activities develop or increase. Smaller terminals that handle international commerce were not found to have any safety or security issues that created a barrier to commerce.

[69] Ibid.
[70] http://www.sourcewatch.org/index.php?title=Somerset_plant

Figure 52: Mount Hope Bay DPA

The Commonwealth, through the Seaport Advisory Council and Executive Office of Public Safety, with the benefit of federal funds, has helped the smaller ports of the Commonwealth. Over $500,000 in federal grants has been received to date to enhance security controls at these ports. A grant was dedicated to the assessment of their physical risk, identifying Port vulnerabilities, recommending mitigation measures, and serving as a tool to assist in the development of federally required facility security plans for the State Pier facilities in New Bedford, Fall River, and Gloucester. Preparation of the required facility plans, as well as mandated training, was undertaken through additional Commonwealth funding support.

Freight Growth Potential

The main area for freight growth is maritime cargo activity at the Fall River State Pier. There is potential in two areas: a container barge feeder service to the PONYNJ with significant opportunity in the near-term, and a short-sea shipping operation for domestic trailer traffic.

In recent years, the State Pier has been an underutilized public asset, operating with a small deficit. While it has the potential for increased cargo shipping, the primary source of income has been rental of storage space, tenant charges for utilities, and vessel charges for dockage. Most of the dockage revenues generated by the facility in 2006 were by the niche fishing industry, and it was this industry that was the primary user of the pier in 2007.[71]

It is expected that with capital improvements, the State Pier can be revitalized, exploiting its full potential. Based on several studies of the pier, the revitalization goal is to create a state-of-the-art cargo and cruise terminal with additional amenities.

Market and Economic Analysis of Prospective Uses[72]

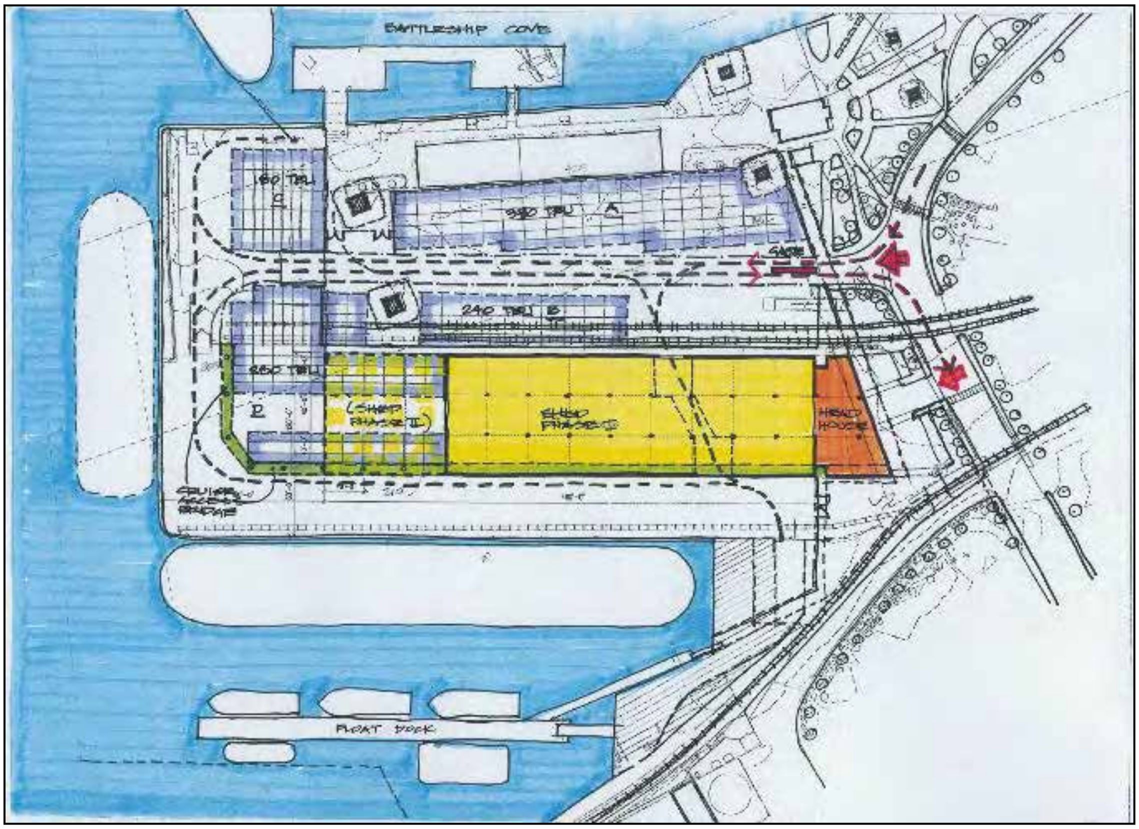
Prospective business uses of the Fall River State Pier identified in recent studies falls into five major areas:

- Maritime cargo operations, including international and domestic (short-sea) container services;
- Passenger cruise ship operations;
- Other passenger vessel operations including passenger ferries, recreational tour and charter vessels, and whale/dolphin watch vessels;
- Secondary marine uses, including commercial fishing and maritime support services; and,
- Tourism, recreational and cultural business activities including a restaurant, as well as a banquet and conference center, that may be used as an exhibition space, a conference and public meeting area, and general office space.

The future use of the State Pier, whether for continued industrial port or tourist and recreational uses, has long been a major issue. Substantial Commonwealth funding presented the opportunity for a plan development process to resolve the appropriate use question. A hard-won consensus was achieved; the pier would be developed as a multi-use facility (Figure 53) accommodating cargo handling on the ground level and potential non-industrial port uses including tourism, recreational, and cultural business activities on a new second level.

[71] Operations Plan for Fall River State Pier Multi-Use Facility, 10-07.
[72] Ibid.

Figure 53: Proposed Site Plan for the Fall River State Pier Multi-Use Maritime Facility



An operations plan has been developed for this use of the facility, providing a blueprint to guide development up to the point of hand-off to commercial operators. The plan calls for incremental implementation. Development of some associated elements is underway. An estimated $31.2 million is needed to complete the project, and adoption of legislation related to management structure is also needed. The phased building program is intended to maintain use of the pier by existing maritime tenants throughout construction. The operations plan recommends that highest priority be given to developing maritime cargo operations. In anticipation of State Pier development as a multi-use facility, major improvements were undertaken and completed in 2006. Current capacity reflects a total rebuild of the west face, providing for a doubling of berth size, single level deck areas, and heavy lift capacity.

There is significant opportunity for the State Pier to increase maritime cargo activity. Fall River is positioned favorably to serve as a feeder hub for PONYNJ, particularly with regard to New England area cargoes originating from/destined to the south and west of Boston. These cargoes are estimated to be 2,500 to 3,000 TEU per week.[73] Other factors contributing to the viability of Fall River include a current business" local cargo base to provide immediate support, highly favorable terminal handling cost for containers loaded and/or discharged at Fall River, and excellent highway access.

The longer term short-sea shipping opportunity legally requires US-constructed vessels. The cost is estimated to be 3-4 times that of a foreign-built vessel, creating a significant capital risk factor for an investor. It was found that short-sea shipping services with roll-on/roll-off

[73] Global Insight.

articulated tug barge vessels might be viable within 24-36 months and mono-hull vessels after 48 months. The size and characteristics of vessels considered viable are:[74]

- Length overall: 190-200 meters (623-656 feet)
- Beam: 24 meters (79 feet)
- Draft: 6.4 meters (21 feet)
- Deadweight: 12,000 DWT
- Road trailers: 140 –150 (primarily 48‟ and 53‟)
- Stern ramp or quarter ramp

While Fall River is extremely well positioned for these maritime cargo operations, there are neighboring ports that have competitive locations and facilities for these activities. New Bedford, Providence, and Davisville fall into this category.

The plan capacity requirements for the two maritime cargo operations vary. Those for the container barge operation include a stacking area size within the projected capacity for the new facility. For the short sea shipping operation, onsite trailer parking space would need to be supplemented, potentially with acreage located across the street from the facility to provide significantly more cargo storage and parking space.[75] It should be noted that this kind of increase in freight activity could potentially be in conflict with the other non-freight initiatives such as mixed use and passenger activities at the State Pier.

There is also potential opportunity for expansion through use of the neighboring Borden Remington property. With projected capacity requirements met for 1050 TEUs or 140 trailers, there would be potential for a weekly barge or coastal shipping operation of 400 containers or trailers per week.

Seafood Industry

To facilitate cargo growth, rail needs to be restored in some areas and trackage improved to accommodate increased cargo shipments. The existing rail spurs on the north side of the shed building on the pier would need to be upgraded to support continued multi-modal transport capability at the pier.

When the operations plan was developed in 2007, the primary user of the Fall River State Pier was the niche fishing industry. The obvious linkage between fish harvesting and processing was leading to increased vertical integration in the industry, with direct ties between fishing fleets and processors. The inclusion of both of these business activities at the State Pier was viewed as an opportunity for strong future growth in selected species of fish.

Three particular species account for the vast majority of Fall River fish landings: deep sea red crab, Atlantic mackerel, and lobster. The total quantity of fish landed at Fall River in 2006 was 20.4 million pounds, an increase of 13 percent over 2005 volumes. The value of the fish landed

[74] Analysis of the Potential Market for Short Sea Shipping Services over the Ports of Fall River and New Bedford, 3/06.

[75] Specifically, according to the plan: "The most important physical assets required at the State Pier for the maritime cargo business activities are berth space of at least 400 feet in length, sufficient stacking area for 500 containers and/or parking space for 300 trailers, covered warehouse space of at least 25,000 square feet, a roll-on/roll-off (roll-on/roll-off) ramp to load and discharge trailers from any stern-loading roll-on/roll-off vessels utilizing the facility, as well as supporting office and parking space for management and operations personnel who would be located at the terminal. It is expected that the stevedore engaged to support any container barge or vessel service operating over the State Pier would provide any shore crane and container-lifting equipment such as reachstackers."

in 2006 was $7.3 million, an increase of 16 percent over 2005 levels. Fall River‟s fish landings‟ growth compares favorably to the rate experienced in the neighboring Port of New Bedford, 11 percent in 2006.[76] New England as a whole reported a growth in fish landings of 10 percent, slightly less than the growth experienced by Fall River.[77]

In addition, the presence of the fishing industry offers the possibility of a synergistic relationship with passenger cruising. Interviews with cruise operators indicate that the presence of a local fishing industry is viewed as a positive attribute for a port of call by cruise ships.

A single fish processing business, Atlantic Frost, is currently located at the State Pier. With current capacity utilization of 50 percent, the company could expand its processing operations given the potential growth in fish catch that would likely support such an expansion.

The proposed new design for the State Pier increases berthing and layover capacity by adding a floating dock in the cove on the south side of the pier. This floating landing would provide berthing space for fishing and other vessels, while freeing space on the existing fixed pier to accommodate larger vessels. The plan recommends construction of the first stage of the floating dock as soon as possible (within the next 12 months). The floating dock provides essential capacity to flexibly support fishery operations, as well as small cruise vessel operations and other passenger vessel operations. Funding for the dock has been approved, engineering is underway, and construction is likely to start in the fall of 2010 according to the Patrick Administration‟s official project status reports.

There is the possible construction of a Liquefied Natural Gas facility in the Port as well. If completed, this would create a large expansion of marine based services in the Port.

Economic Development and Land/Water Use

The Fall River State Pier multi-use facility would combine commercial port activities with public tourism and recreational activities. This supports the community‟s multi-use vision for its overall waterfront, as well as the Commonwealth‟s vision for expanding coastal shipping and cruise industries. It presents a well-vetted potential opportunity for economic development, capitalizing on port assets owned and invested in by the Commonwealth.

The land use context for the State Pier, in addition to neighboring industrial uses such as the Borden Remington plant, includes a number of important cultural and recreational sites along the Fall River waterfront. These include the adjacent Battleship Cove, as well as the scenic boardwalk along the Taunton River, Heritage State Park, the antique carousel, the Marine Museum of Fall River, and the emerging arts and cultural district of downtown Fall River. To fit with this context, the new terminal building at the State Pier is intended to have a very public presence along Water Street.

The pier has a significant opportunity to improve its financial contribution to the facility‟s bottom line, if it can generate significantly greater business activity. This will require a major capital investment to upgrade the pier‟s facilities and infrastructure, estimated to be in the range of $31.2 to $44.9 million. This investment would help attract business and better manage the increased business volumes that could result.

[76] NOAA Fisheries, Office of Science and Technology.
[77] NOAA Northeast Fisheries Science Center.

Strategic Opportunities and Recommended Improvements

The Port of Fall River is well protected, has support mechanisms in place for commercial vessel activity, has cargo storage and handling capacity, and is supported by good road and rail access.

It is recommended that the operations plan for development of the multi-use facility at the State Pier be implemented. Construction of the floating dock on the south side of the pier to provide berthing space for fishing vessels and other types, while freeing space on the existing fixed pier for larger vessels of cargo shipping operations, is also recommended. Completion of the other priority elements detailed in the plan will provide the infrastructure needed to exploit market opportunities for a barge cargo shipping operation in the near term and a short sea shipping operation in the longer term.

Funding for repairs of the State Pier"s south berth and installation of a new floating dock of $1.1 million has been approved by the MA Seaport Advisory Council. A fall 2010 start date for construction is expected, with completion anticipated in two years. Total estimated cost for the State Pier multi-use facility is $31.2 million dollars (not including the floating dock). Construction of the entire facility is anticipated to take five years.

Opposition to the LNG terminal has led to legislation reported out of State House and Senate committees in July 2008, HR 415 and S 868. These bills would designate the lower Taunton River in Fall River, the location of industrial port areas, as "Wild and Scenic." If passed into law, the impact to industrial port activity needs to be understood and a response considered.

Improvements to the infrastructure for freight rail carriers, enhancing their ability to compete for freight business in the region, are recommended. As part of this, construction of double tracks to improve both the movement of freight and the scheduling of potential future commuter trains is encouraged.

Maintenance dredging of the main shipping channel of the Port, as well the two locations requested by the Somerset Power Plant, including its vessel-berthing basin, should be completed.

2.5.2.3 Port of Gloucester

The Port of Gloucester is located on Cape Ann and is approximately 26 miles north of Boston and 234 miles north of New York. Cape Ann is located adjacent to the main shipping routes between Southern and Northern New England. The Port is historically known for its fishing industry.

In recent years, the catch of groundfish (e.g., cod, haddock, sole) has declined with the decline in stocks and management rules limiting catch to rebuild the stock. Fishing of other species has increased, and the Port supports an active fish processing industry. The Jodrey State Fish Pier is a major facility in the Port. Principal businesses are fishing, fish processing, recreational boating, marine repair and supply, and a fledgling cruise ship business.

Infrastructure and Facilities

Gloucester Harbor is a well-protected harbor with an easily navigable entrance and broad inner harbor located on the south shore of Cape Ann. The entrance to the Port is close to the pilot station located in Massachusetts Bay. Pilotage is mandatory for foreign vessels over 350 gross tons and for US vessels over 10,000 gross tons. The outer harbor has a protective breakwater that extends from the east side of harbor entrance at Eastern Point. Primary access is on the western side of the harbor entrance. The harbor has varying depths shallowing quickly from about 18-52 feet outside the entrance, to 25-30 feet within the harbor, to less than 15-24 feet in the inner reaches. The channel entrance is approximately 400 yards wide with depths of 38-47 feet into the outer harbor. Tidal range is about 8.7 feet on average and currents within the harbor are nominal. Parts of the harbor entrance are difficult to traverse, due to breaking waves in severe weather and a number of shoals and submerged obstacles.

Access to the inner harbor is by a 300-foot wide project channel of 20-foot depth. There are shallow channel (less than 20 feet) accesses to the State Pier, Gloucester Marine Terminal, and East Gloucester. Landside access is via Route 128, which connects directly to the State Pier. The Port has no freight rail service.

Major port facilities are located in Gloucester‟s Inner Harbor.[78] The Jodrey State Fish Pier, dedicated to fishing activities, is the major public facility in the Port. The Commonwealth Department of Conservation and Recreation, landlord of the State Pier, leases it to the Massachusetts Development Finance Agency.

Figure 54: Gloucester Inner Harbor

[78] The Inner Harbor defined by a line between the Fort Point on the western shore and Rocky Neck peninsula on the east (See Figure 54 above).

The 7.8-acre facility has a 44,000 square foot wharf with 1400 feet of berthing with depths of between 17 and 20 feet. It has a 54-commercial fishing vessel berthing capacity. There are several buildings that support the fishing industry on site, including a freezer/cold storage building. A 20-foot deep channel provides access to the pier.

The Port has extensive frozen fish processing facilities – reportedly the greatest total capacity for cold storage facilities of any US East Coast port.[79] Product for fish processing is supplied by commercial truck and the local fishing fleet. Processed product is exported from the area by commercial truck.

Port of Gloucester Business Lines

- Seafood industry (harvesting and fresh and frozen processing)
- Freezer/cold storage
- Cruise operations

The Port has developed a small cruise ship facility known as the Gloucester Marine Terminal, at Rowe Square to the west of the State Pier. The terminal is accessed via the North Channel of Gloucester Inner Harbor and can accommodate vessels up to 500 feet (152.4m) in length and drawing up to 18 feet (5.5m). The facility is owned by the City of Gloucester and privately operated.

There are a number of repair yards and associated business, as well businesses that support marine activities, including several small boat marinas.

Between 2005 and 2007, cargo volumes and values fluctuated, dropping significantly in 2006, and then rising significantly in 2007 (see Table 23). Value per volume dropped significantly in 2007. According to US Army Corps of Engineers data for 2006, the total volume of waterborne cargo, other than fish, for Gloucester Harbor was 9,000 short tons of distillate fuel oil.

Table 23: Gloucester Cargo Values and Volumes 2005-2007[80]

Type	2007	2006	2005
Imports ($)	$530,322	$101,474	$136,731
Imports (tons)	535	41	24
Exports ($)	$2,040,491	$372,394	$2,703,682
Exports (tons)	1,352	63	341
Total Value ($)	**$2,570,813**	**$473,868**	**$2,840,413**
Total Volume (tons)	**1,887**	**104**	**365**

Issues, Constraints and Bottlenecks

The Port is well sheltered and while the harbor entrance is deep, it is narrow and shallows quickly. There is little deep-water access to shore areas where large vessels can handle freight. Highway access via Route 128 connecting directly to the State Pier is excellent. There is commuter rail passenger service to the city, but no freight rail connectivity. The immediate area in and around the shoreline is congested and has mixed traffic flow.

Fish, whether locally caught, transported in, or processed product, is the major freight of Gloucester. Locally caught groundfish has been and remains the fish species of high importance to the Port. The volume and value of groundfish landings in Gloucester and

[79] Gloucester Draft Harbor Plan, 2006.
[80] STAT-USA and Foreign Trade Division, US Census Bureau www.usatradeonline.gov

proximity of the species" fishing grounds to the Port have given groundfish this importance. Over the past two decades, groundfish stocks have been in decline. In response, a regulatory system was imposed to rebuild the stocks. The decline and the measures to address it have significantly impacted Gloucester, because of the importance of the groundfish fishery to the Port. With the decline in groundfish, Gloucester has engaged in other fisheries, including lobster, tuna, hagfish, monkfish, herring, mackerel, whiting, and scallops.

Based on its 1975-2003 average share of total NE groundfish landings, Gloucester"s projected share of future groundfish landings in 2015 is 53.5 million pounds. This would present a capacity problem both for the harvesting and processing sectors of the fishing industry. Accommodating this volume would require use of large 70-100-foot vessels. Gloucester is, for the most part, a port capable of handling small and medium-sized vessels. Furthermore, since Gloucester is a regional hub port for the commercial fishing industry, both homeported and other ports" vessels and their landings would have to be accommodated. The increased supply of *fresh* fish for processing would require increased processing capacity in facilities handling fresh fish.

In 2005, Gloucester ranked first in Massachusetts in lobster landings, a high value species. In 2006, it was second in the US Atlantic in volumes of landings of mackerel, though the price of this species is much less than groundfish or lobster. National rankings in fish volumes and value are shown in Table 24 and indicate that Gloucester slipped from 6th to 14th in value of landings between 2000 and 2007.

Table 24: Gloucester Commercial Fishery Landings by US Port Ranked by Dollars

Year	Rank	lbs in Millions	$ in Millions
2007	14	94.4	46.8
2006	11	117.4	47.3
2005	11	124.2	46.0
2003	13	88.8	37.8
2002	9	78.5	41.2
2000	6	43.2	41.9

Source: http://www.st.nmfs.noaa.gov/pls/webpls/MF_LPORT_YEARD.RESULTS

A concern for the community is the state of its fishing industry landside infrastructure As some fishing businesses have failed or turned from fish-related to other types of enterprise, infrastructure maintenance has not kept up. The concern is that when groundfish stocks rebound and landings increase as predicted, the infrastructure in Gloucester will not be there to handle it.

Gloucester"s commercial fishing industry needs include additional dock space, particularly berths for large vessels of all types; permanent, short-term, as well as transient, areas for unloading and loading fish, gear, and supplies; dredging at existing or new berths; large-vessel haul-out facilities; services for visiting vessels; and fresh fish processing capacity.

A shift in the mode of transport of fish processing product, from the current dominance of road to water, does not appear to be an opportunity. Volumes are low enough that trucks handle less than full containers in transport to Boston; this dictates the choice of the fish processor on the State Fish Pier to transport product via road, rather than water.[81]

Environmental Impact Issues and Initiatives

According to stakeholders and local port experts, environmental and other regulatory restrictions are the largest issue in Gloucester, because they are preventing dredging, restricting fish processing, and hurting ship maintenance businesses.

Dredging is needed of both existing and potential new berthing areas to accommodate fishing vessels. It is also needed in the main shipping channel, from its current 20-foot depth to 24 feet, to accommodate fishing, as well as cruise industry vessels. To accomplish these dredging efforts, the development of a dredged materials disposal plan identifying a feasible disposal site will be required. In the past, reaching agreement on a dredged disposal site has been an obstacle to moving forward with a dredging project.

Appropriate disposal of fish processing waste has long-been an environmental issue in Gloucester. A private sector initiative has made this issue into an opportunity. Neptune‟s Harvest is a Port facility that converts previously disposed fish product into a usable consumer product, organic liquid fertilizer, helping to mitigate the waste disposal issue.[82]

Economic Development and Land Use

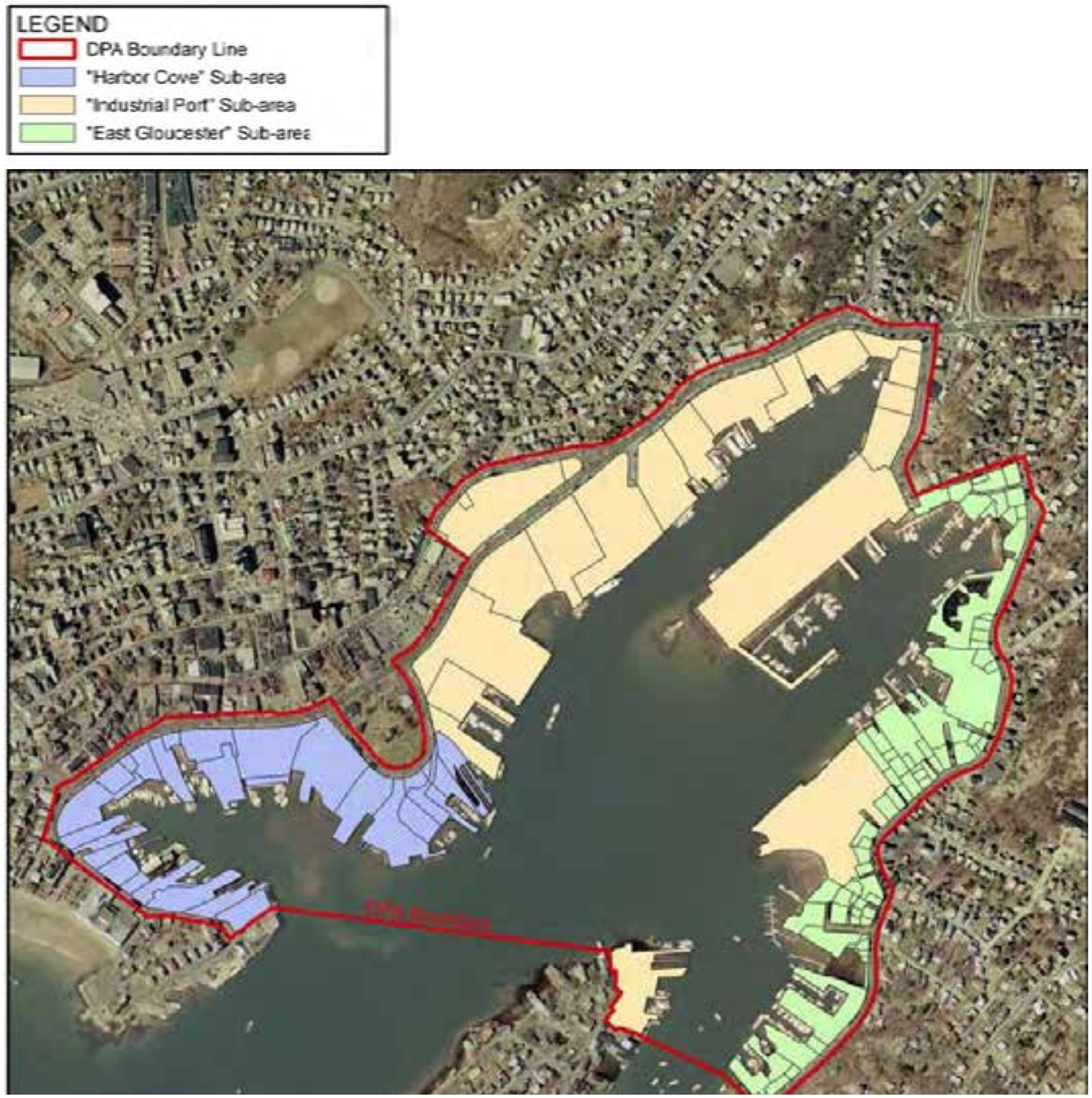
Port industries, and the fishing port industry in particular, are subject to downturns. During these downturns, it is difficult for them to maintain their space and facilities dependent on waterfront locations and waterside access. Space is limited, non-renewable, and there is often pressure for competing, sometimes conflicting, uses.

The DPA regulations, as revised in the 1990s, addressed the need to both protect port industry and provide flexibility to allow uses that could provide economic support to port industry. These uses could be potentially valuable in times of stress, and they could meet a fuller range of community goals with regard to the character of their waterfronts. Studies indicate that Gloucester has not fully capitalized upon this flexibility.

The Gloucester community completed a revised harbor plan in 2009 that speaks to the issue of waterfront uses.[83] There are existing local regulations that restrict waterfront development, to protect the fishing industry. A broad planning process has been undertaken, providing an opportunity for the community to reach a consensus on this issue in a manner that balances both fishing industry needs and other community goals. A 2006 draft Harbor Plan divided the DPA into three areas based on their land use character (see figure below).

The office of the Mayor of Gloucester recently issued a press release on the revised Harbor Plan describing it as being firmly grounded in the Commonwealth's DPA program. In addition, the City of Gloucester is currently preparing an economic development plan for Gloucester Harbor. The plan is focused on studying ways to strengthen key harbor-related industries, including commercial fishing, other maritime industry, and tourism. In addition, the plan will evaluate ways to build new industries that complement the harbor‟s existing industry base and better connect the harbor and Gloucester‟s downtown.[84]

[81] Interview of Director of Jodrey State Fish Pier.
[82] 2006 Gloucester Draft Harbor Plan.
[83] http://www.uhi.umb.edu/pdf_files/City%20of%20Gloucester%20Harbor%20Plan%20July%202009.pdf
[84] City of Gloucester Website.



• *Industrial Port – An area of almost uniform Marine Industrial use incorporating the State Fish Pier, the Americold property, and Gloucester and the Marine Railway on Rocky Neck. It is characterized by major fish processing, cold storage facilities and support services that have developed here over the past forty years on large parcels in large buildings, with berthing accommodating large vessels, and proximity to the main shipping channel and the end of Route 128.*

• *Harbor Cove – The traditional heart of the fishing port in Gloucester, characterized by a mix of commercial and industrial uses, located on small parcels, and old finger piers.*

• *East Gloucester – An area featuring generally poor road access for large commercial vehicles and a diverse mix of uses, building types, and waterfront conditions, including boatyards and marinas that service both recreational and commercial vessels and private homes. It is the only area within the DPA that has "grandfathered" residences and recreational marinas.*

Safety and Security

Safety and security are critical issues in all port operations. Smaller ports, such as Gloucester, are advised to mirror some of the protocols that are already in place at Massport, as their activities develop or increase. Smaller terminals that handle international commerce were not found to have any safety or security issues that created a barrier to commerce.

The Commonwealth, through the Seaport Advisory Council and Executive Office of Public Safety, with the benefit of federal funds, has helped the smaller ports of the Commonwealth. Over $500,000 in federal grants has been received to date to enhance security controls at these ports. A grant was dedicated to the assessment of their physical risk, identifying Port vulnerabilities, recommending mitigation measures, and serving as a tool to assist in the development of federally required facility security plans for the State Pier facilities in New Bedford, Fall River, and Gloucester. Preparation of the required facility plans, as well as mandated training, was undertaken through additional Commonwealth funding support.

Strategic Opportunities and Recommended Improvements

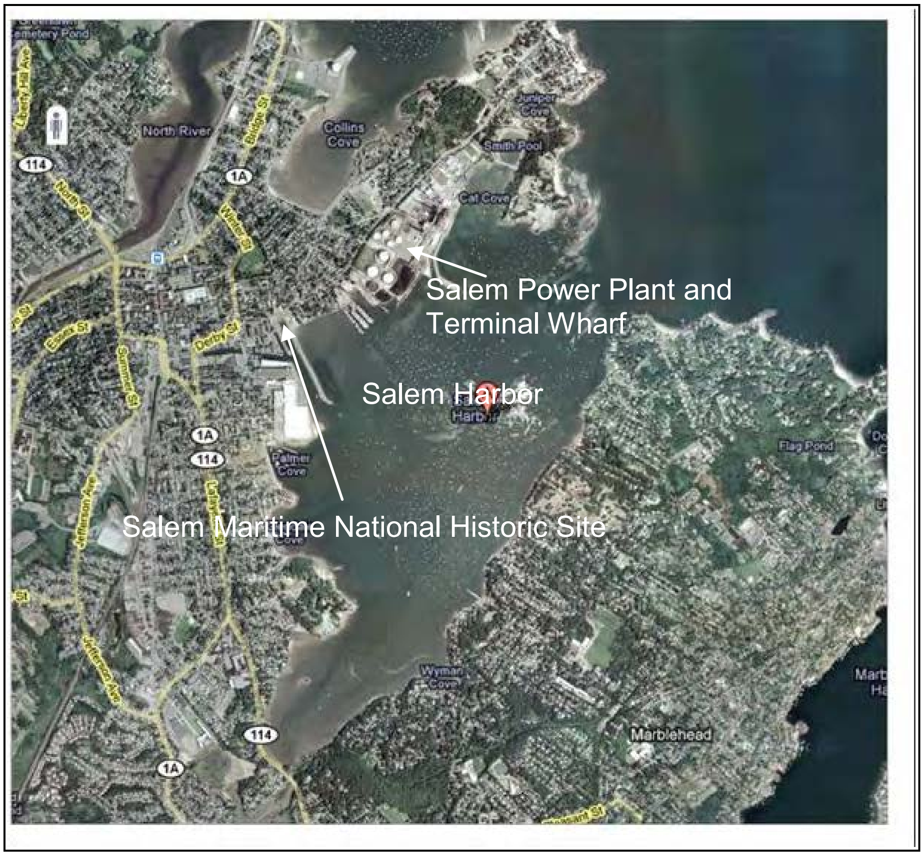
Previous studies identify key opportunities in the fishing industry, highlighting the importance of improving the commercial fishing infrastructure to capture the benefits of the increased supply of groundfish that is to occur, as stocks continue to rebuild. Increased value-added activity from increased fresh fish processing is one possible opportunity.

Recommended improvements for consideration include:

- Undertaking improvement dredging of the inner harbor shipping channel to a depth of 24 feet;
- Developing additional dock space, particularly berths for large vessels, of all types (permanent, short-term, as well as transient) for unloading and loading fish, gear, and supplies;
- Dredging at existing and new berths;
- Providing large-vessel haul-out facilities;
- Providing services for visiting commercial fishing vessels; and
- Expanding fresh fish processing capacity.

2.5.2.4 Port of Salem

The Port of Salem is located 11 miles southwestward of Cape Ann and is approximately 12 miles northeast of Boston.



Despite being primarily known for its historic tourism, recreational activities, and yachting industry, the Port also has an important industrial area. The industrial area is dominated by a power plant facility, which is fueled by coal and oil, with commodities delivered to it by waterborne transport. Located on the northeast shore of Salem Harbor, the Salem industrial port area largely coincides with the Commonwealth Designated Port Area (DPA). Tourist and recreational activities, and moorings for a range of visiting vessels, are located along the historic waterfront area of the Harbor where the Salem Maritime Historic site is found.

Infrastructure and Facilities

Primary access for deep-draft vessels in Salem Harbor is the Salem Channel, extending from the northeast and leading to the industrial port area (see Figure 55). It is a federally maintained channel with a depth of 32-feet, a length of 1.6 miles, and a width of 300 feet, expanding to 400 feet at its turns. Maintenance dredging of the channel was last done in 2007, funded and managed by the US Army Corps of Engineers; the turning basin to which the channel connects was last done in 2002 by the Salem Power Plant.[85]

> **Salem Harbor**
>
> The overall range of the tide in the harbor is between 8.5 and 9 feet. Within the harbor the current has minimal velocity. There is ice buildup at the head of the harbor during very cold winter months, mostly in January and February. Pilotage is mandatory for foreign vessels drawing over seven feet. Tugs services are available out of Boston. Salem is a US Customs Port of Entry. There are no dry-dock or shipyard facilities in the port for servicing large commercial craft.

Landside access is via Routes 128, Route 114, and local roads. There is no freight rail service.

The 67-acre Salem Power Plant Station and associated oil terminal and berthing facility (Salem Terminal Wharf) for oil and coal deliveries is the single industrial port facility. It dominates the Salem DPA and is a significant element of the city"s overall waterfront, and importantly, its overall economy. The station, purchased by Dominion Energy in 2005, has three coal-fired units and one oil-fired unit with a total

[85] Salem Harbor Plan 2008.

generating capacity of 745 megawatts, or enough electricity for about 745,000 homes. Salem Terminal Wharf is approximately 700 feet long. At the west side of the Wharf is a turning basin, with a controlling depth of 27 feet, connecting to the Salem Channel.

According to the Salem Power Plant, coal and oil is transported by twenty vessel calls per year and capacity of the facility is approximately 100,000 tons of coal and 1 million barrels of oil.

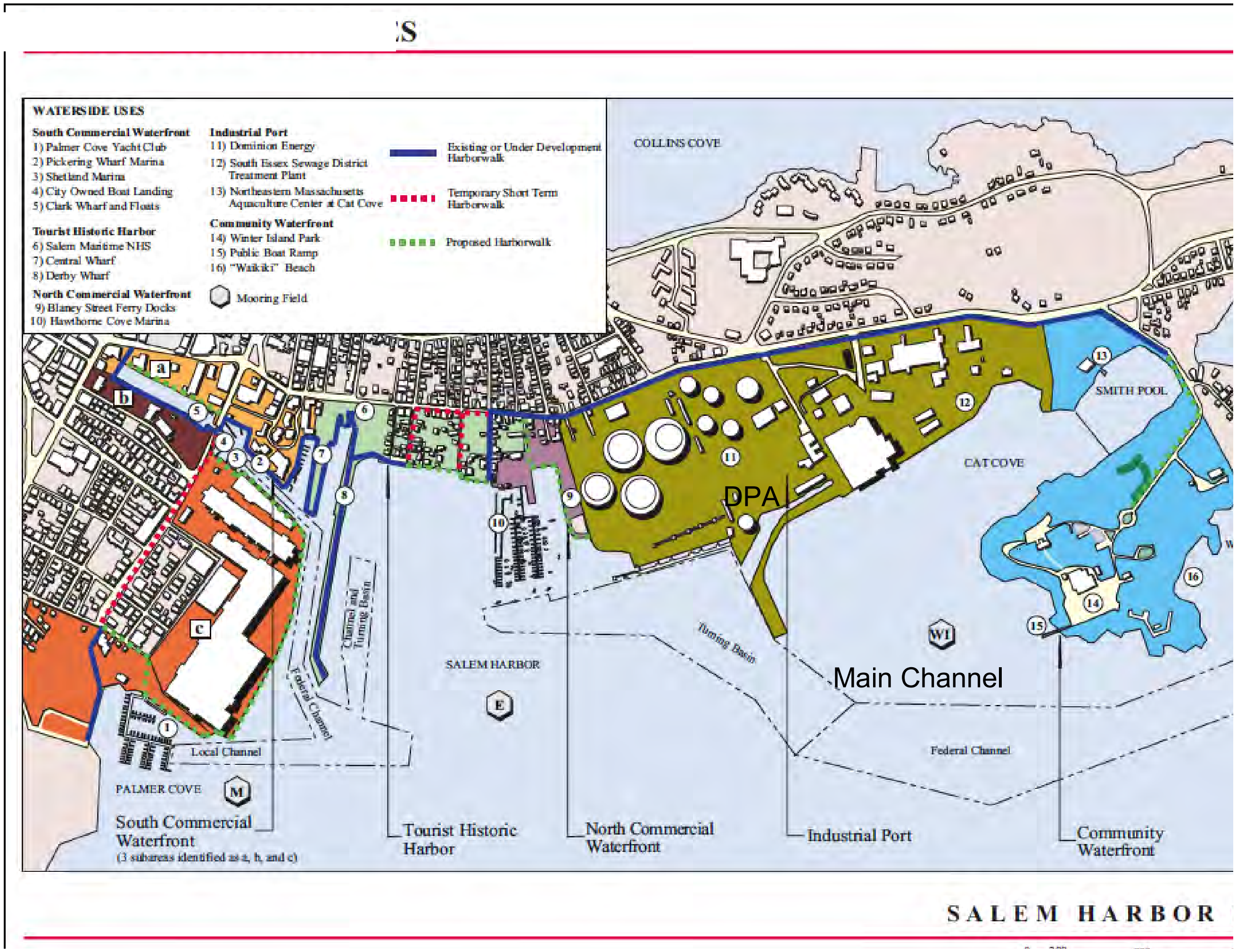
As Table 25 reveals, the volumes and value of cargo, oil and coal deliveries to the Power Plant have decreased between 2005 and 2007. This trend reflects changes in fuel prices as is discussed in more detail below.

Table 25: Port of Salem Cargo Value and Volumes, 2005-2007

Type	2007	2006	2005
Imports ($ thousands)	$35,564	$49,482	$54,849
Imports (short tons)	777,426	1,029,808	1,004,193
Exports ($ thousands)	$10,036	$14,549	$13,372
Exports (short tons)	3,067	4,094	3,971
Total Value ($ thousands)	**$45,600**	**$64,031**	**$68,220**
Total Volumes (short tons)	**780,493**	**1,033,902**	**1,008,164**

Source: STAT-USA and Foreign Trade Division, US Census Bureau www.usatradeonline.gov

Figure 55: Waterside Uses



Issues, Constraints and Bottlenecks

There is little upland space with deepwater access in the Port of Salem for the development of freight activities, other than that currently available at the Power Plant site. The immediate area in and around the Port is congested and has poor capacity for truck traffic flow. Although there is rail service to the city, it is limited at this time to commuter rail.

Environmental Impact Issues and Initiatives

With the dramatic increase in the cost of oil and gas in 2005, the demand for cheaper energy sources increased, creating an increased demand on coal burning power plants, such as the Salem Power Plant. The plant responded to the demand, increasing its output.

Coal deliveries to the Port of Salem in 2006 were 1,064,000 short tons, while oil deliveries were 35,000 short tons. This is not surprising, when one considers that coal is cheaper than oil. Additionally, coal is the second leading generation fuel in Massachusetts used, on average, for about one-fourth of the Commonwealth‟s net electricity production. Petroleum is used less often, the third leading generation fuel, decreasing since 1990. Natural gas is now favored, as it is a cleaner-burning fuel.[86]

Freight Growth Potential

The freight market for Salem, consisting of the fuel sources for the Power Plant, has been consistent with local demand trends, which are influenced strongly by the cost of the fuel type, and its environmental impact. The market also depends on the continued operation of the power plant facility in its present location.

Economic Development and Land Use

According to Boston Globe articles (11-06-08 and 12-4-08), operation of the Salem Power Plant, now generating electrical power for 300,000 homes, is needed if there is to be a reliable supply in the Boston area. According to the Mayor‟s office, the plant generates the city‟s largest tax revenues. Under a recently accepted agreement with the city, it will pay the 2009 amount paid of $4.75 million in 2010 and 2011. In addition, it will continue to provide 147 jobs. As a result, the Mayor feels strongly that any consideration of redevelopment of the plant site needs to be based on a detailed financial analysis of its impacts on the city, adding that a mixed-use redevelopment would not generate the amount paid annually by Dominion.

The Salem Power Plant falls within an Industrial Port District of Salem overlay zone developed by the city subject to Commonwealth development standards. The boundaries of the two areas are generally consistent. Covering approximately 78 acres, the Industrial Port District encompasses all but five acres of the landside portions of the DPA. It includes the South Essex Sewage District Treatment Plant adjacent to Dominion Energy facilities, but not in the DPA. DPA boundaries extend waterside and include the federal channel, turning basin, and area of the watersheet adjacent to and southeast of the Dominion Energy site. To the immediate south of the Power Plant site and DPA is a marina. To their west are residential uses, which present some conflict.

[86] Energy Information Administration.

Figure 56: Land-and Waterside DPA Boundaries

Source: Compiled from maps provided by DEP
Note: Chapter 91 boundary coincides with the historic high water mark

The 2008 Salem Harbor Plan supports the continued use of the Dominion Energy site for its current use. While in its 2008 Harbor Plan the city proposes no change in the existing Dominion Energy facility uses, it is also developing a plan to expand the Port area in ways that provide for potential commercial growth opportunities. The expansion plan provides for facilities to accommodate tourism-based cruise business, the Salem Ferry, an offshore supply vessel, lobster vessels, excursion vessels, and a water taxi.

Strategic Opportunities and Recommended Improvements

Salem is not viewed as having significant potential for port-based freight growth, with the exception of one area. There is potential for providing supplemental marine support for the expanding petroleum and gas network in New England. While the Terminal is primarily used to supply the needs of the Salem Power Plant, it has the capacity to handle additional bulk liquid cargo operations. As more pressure to reduce tank and storage capacity increases in the New England region, Salem may be in a position to provide increased liquid bulk and gas product handling capacity needs.

The Port industrial area is dominated by one maritime freight-related facility. While its current owners have committed to continue operations, circumstances could change, and the operations could feasibly cease. Whether this constitutes a threat or an opportunity to the industrial port area and its public purpose will depend on what strategy for the future is articulated and agreed upon, well enough in advance of a change, that its implementation is achievable.

The City, in it most recent planning efforts, has laid the groundwork for creating an opportunity, calling for alternative forms of energy production (long term) within the DPA.

"*The Industrial Port planning area with its DPA is envisioned to continue to be a site suitable and appropriate for energy production into the foreseeable future. As new/alternative energy sources evolve (e.g. solar, wind, geothermal, tidal), [it] is recommended that the site continue to be considered] for supporting different energy production technologies and operations" (2008 Salem Harbor Plan).*

There are no major improvements recommended for this port.

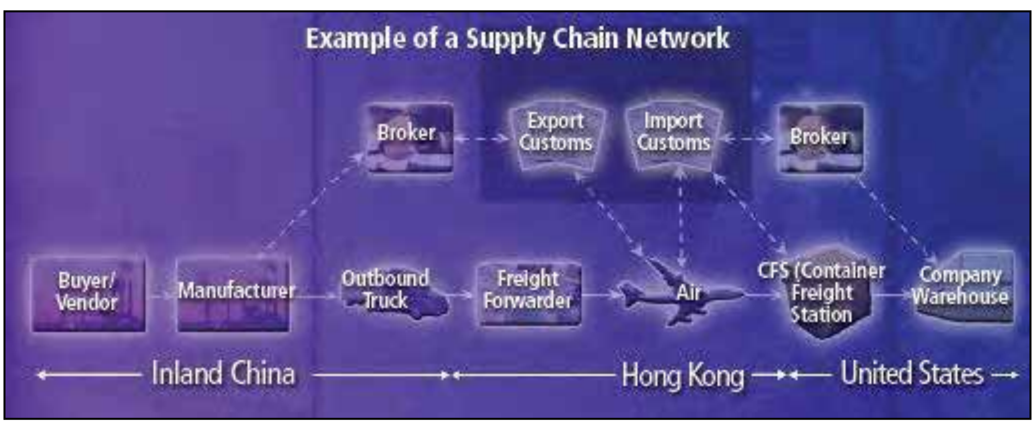
2.6 EXISTING CONDITIONS OF THE MASSACHUSETTS AIR FREIGHT SYSTEM

As international trade expands, it impacts the regional transportation network across all modes. In Massachusetts, air freight has been increasing in importance as the Commonwealth‟s economy continues to shift towards high-value, high-technology businesses that are connected internationally and domestically. Air freight constitutes about 0.1 percent of all freight tonnage in Massachusetts, yet it carries 5.5 percent of the value, and is projected to be the fastest growing mode for freight over the next 25 years, increasing by up to five times current volumes according to the US DOT‟s Freight Analysis Framework data.

While relatively small in terms of tonnage, shipments by air freight represent significant value as Massachusetts businesses increasingly rely on lighter-weight, higher-value goods movement. This section of the Freight Plan examines the Massachusetts air freight system – a critical component of the Commonwealth‟s domestic and international trade infrastructure and services.

Internationally, the value of exports and imports rose in constant dollars from $2.1 trillion in 2002 to $2.5 trillion in 2007, and the tonnage increased from 1.7 billion to nearly 2.0 billion in the same period. The value of merchandise trade has grown sixteen-fold in inflation-adjusted terms since 1951. As these trade volumes and values continue to rise, goods movement by air freight is becoming an increasingly important element of the global supply chain network as illustrated in Figure 57.

Figure 57: Illustration of Supply Chain



Source: Battelle Memorial Institute

This diagram shows a schematic example of a typical supply chain network showing the modes and phases needed for a specific shipment from China to the United States.

2.6.1 AIR FREIGHT IN THE NEW ENGLAND REGION

The New England Regional Airport System Plan (NERASP) was prepared through the collaboration of eleven of the region‟s major airports, the six Commonwealth aviation agencies, Massachusetts Port Authority, Federal Aviation Administration and the regional business organization, the New England Council. The plan provides a foundation for a regional strategy to meet air passenger needs through 2020 by development of a regional system that is efficient, convenient and reliable. Although focused on passenger services, the Plan does address air cargo needs and establishes a framework to enhance these services within the region.

NERASP findings related to air freight include:

- Moderate economic growth is projected for the region as compared to other regions in North America.
- Increased trucking modal share for goods movement in the region, especially in the densely developed metropolitan areas.
- Slight decline in domestic and international air cargo growth after 2010 reflecting the projected moderate economic growth in the region.
- Gradual economic recovery nationally and internationally will spur global trade and result in more direct routes to and from New England through 2025.
- Increased international flights from Logan will stem leakage of international air cargo from New England to JFK in New York.

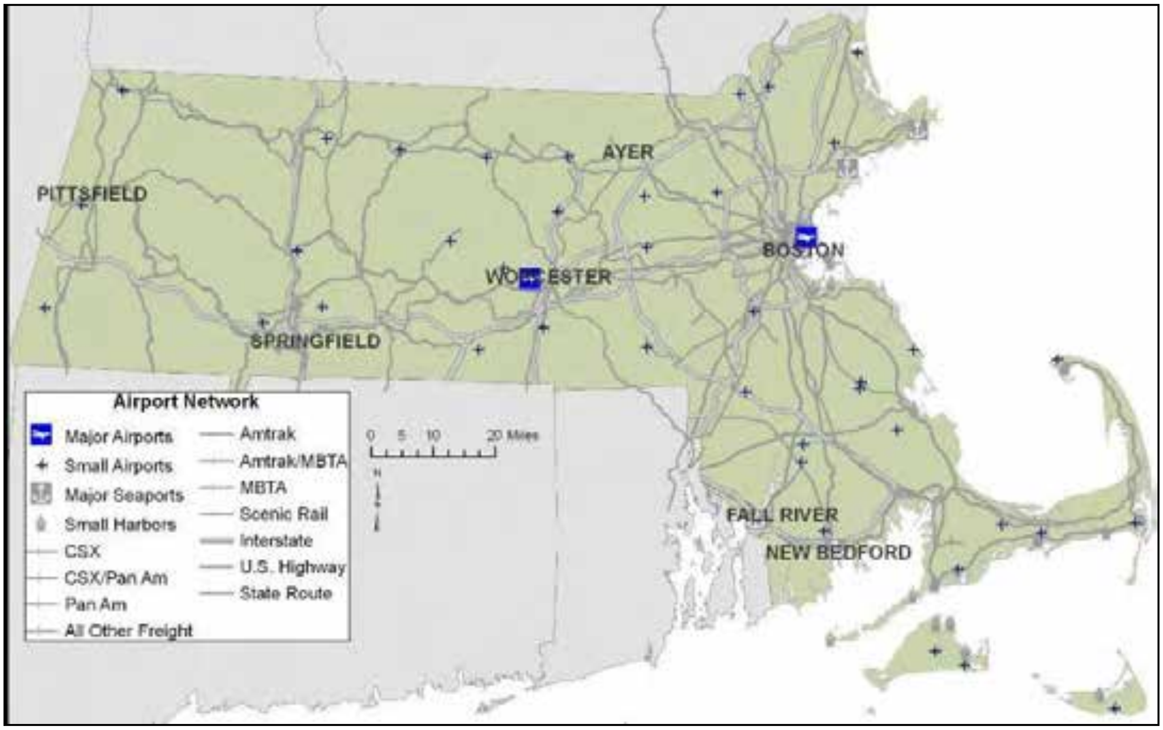
This regional planning effort acknowledges that Boston‟s Logan International Airport will continue to dominate the New England region in moving goods via air freight services.

2.6.2 EXISTING AIR FREIGHT SERVICE IN MASSACHUSETTS

The commodities using air freight reflect the changing nature of the Massachusetts and regional economies. Today, air cargo shipments include pharmaceuticals, high technology and bio-technology materials and equipment, and even high value food products such as seafood and organic produce. In addition, parcel shipments sent by companies such as FedEx and UPS represent the largest volume by weight of air freight. Consequently, air cargo services are essential elements of a multi-modal transportation system that meets the needs of both emerging and traditional businesses in the Commonwealth.

The Massachusetts airports network is illustrated in Figure 58 with Boston and Worcester being the largest airport facilities in the Commonwealth. Air freight can be handled in most any passenger airplane, and high value time sensitive shipments may use many other airports throughout the Commonwealth and region. Air freight is classified as domestic, international or express, with the latter better described as package services such as the US Postal Service (USPS), UPS, or FedEx. Air cargo is carried in passenger planes (“belly cargo”) or in freight only carrier fleets.

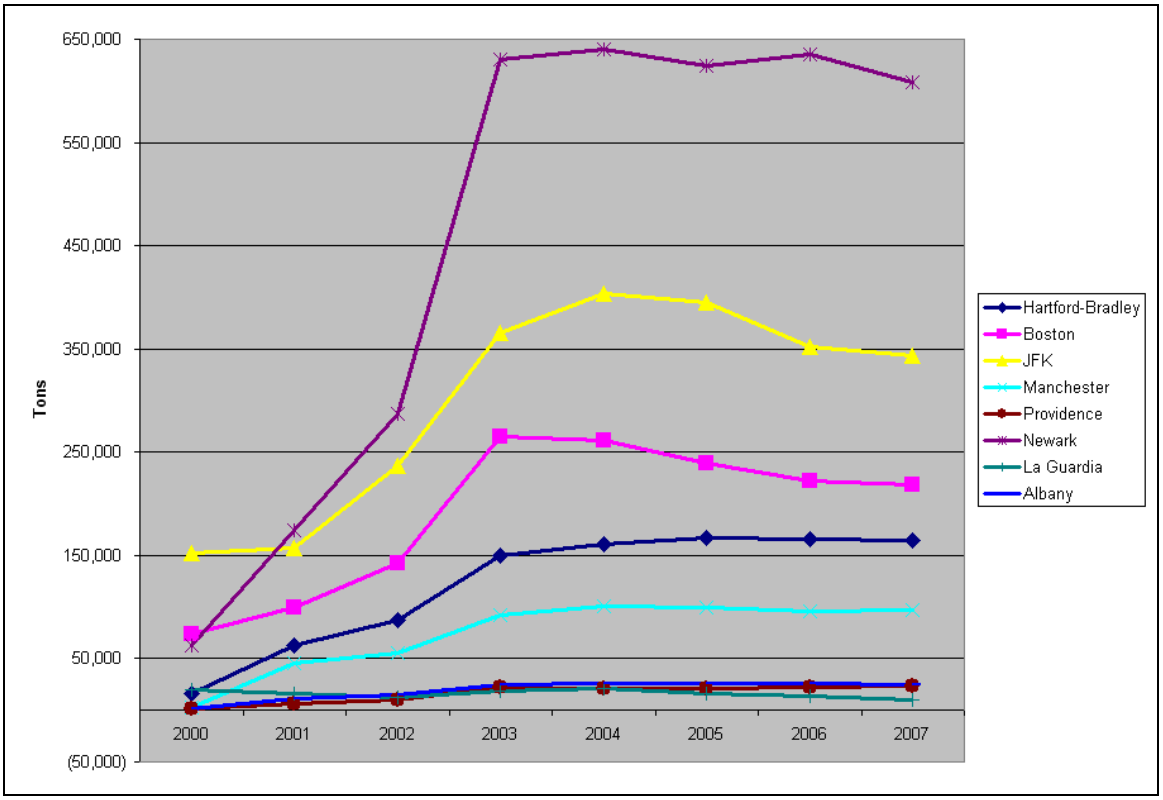
Figure 58: Massachusetts Air Freight Facilities



Boston‟s Logan Airport moved 218,965 tons of domestic air cargo in 2007, the most domestic tonnage of all New England airports, followed by Bradley Airport‟s (Hartford) 164,667 tons and Manchester (see Figure 59). Regionally, only Newark and JFK carry more total domestic freight tonnage than Logan Airport. Since 2005, only Providence has shown positive growth in total domestic freight tonnage, while growth for Manchester, Newark, and Albany airports remained relatively flat.[87]

[87] New England Regional Airport System Plan.

Figure 59: Domestic Air Freight Tonnage for Major Northeast Airports



Source: BTS Transtats T-100 Domestic Market (US Carriers)

The majority of domestic and international air freight leaving Massachusetts, in terms of dollar value, exits via Logan Airport. Of the export goods produced in Massachusetts Logan Airport ships more international freight by value than any other New England Airport, and was just ahead of JFK in New York (see Table 26). In contrast to the relatively flat air tonnage trends, the value of international air exports more than doubled from 1997 to 2007 (not accounting for inflation). New York"s JFK Airport ships the second largest dollar amount of international air freight originating from Massachusetts businesses, and was the largest airport for Massachusetts export shipments by air as recently as 1997. In 2007, over $6.8 billion dollars of domestic and international air freight from Massachusetts flew out of New York"s JFK Airport.[88] The total value of Logan air freight, including domestic and international shipments, in 2007 was $8.8 billion dollars confirming air freight has a very high value to weight ratio.[89]

[88] WISERTrade Data.
[89] Massachusetts Port Authority.

Table 26: Massachusetts International Exports by Airport

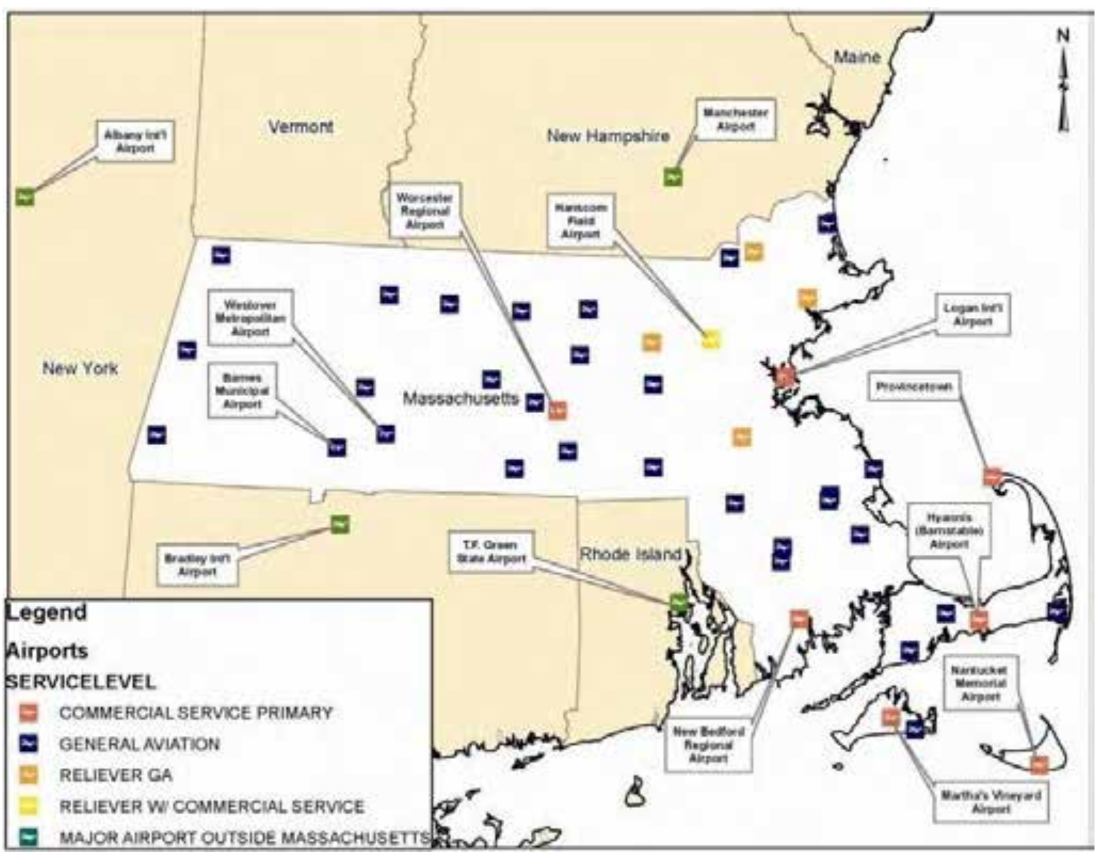
	1997	2007	Percent Growth
Logan Airport-Boston, MA	$3,433	$7,121	107%
J.F.K. Int. Airport, NY	$4,473	$6,849	53%
Miami Int. Airport, FL	$170	$291	72%
Los Angeles Int. Airport, CA	$176	$135	-23%
San Francisco Int. Airport, CA	$177	$58	-67%

Source: WISERTrade Data

2.6.3 INFRASTRUCTURE AND OPERATIONS BY AIRPORT

In Massachusetts, the majority of air freight is shipped into and out of airports that also handle passenger traffic. Most air freight is shipped by utilizing the cargo areas of passenger flights, referred to as "belly cargo." Given the large number of passenger flights and express shipping demand in Boston, Logan Airport is by far the busiest air freight facility in Massachusetts. Figure 60 illustrates the major airports in Massachusetts and their service levels.

Figure 60: Massachusetts Airports Service Level



Also illustrated on this map are air freight service facilities outside of Massachusetts. In New Hampshire, the Boston-Manchester Regional Airport in Manchester provides limited levels of freight service. Bradley International in Hartford and T. F. Green in Providence also serve air freight needs within their respective service areas and are used by Massachusetts businesses, primarily for domestic air cargo. The major international air freight service location in the northeast region is John F. Kennedy International airport in New York. This facility serves a large catchment area including much of southern New England based on its extensive direct flights to international locations.

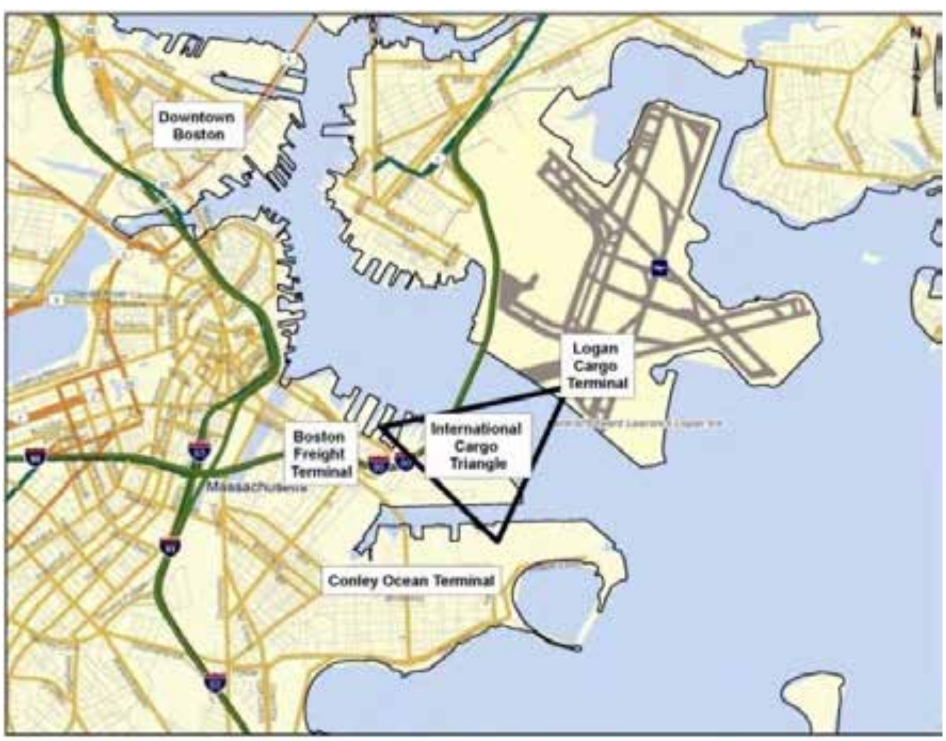
Given their proximity to New York‟s JFK airport, Massachusetts air freight shippers have several options to meet both current and future demand for services. The smaller, regional airports in Massachusetts are expected to continue to play a minor role in air freight operations.

Of the smaller regional general aviation airports, Barnstable Municipal-Boardman Polando Field, Nantucket Memorial, New Bedford Regional, and Martha‟s Vineyard have daily air cargo operations; Orange Municipal, Marlboro, and Turners Falls each have monthly air cargo; and Westover Air Reserve Base, Worcester Regional, Lawrence Municipal, Marshfield Municipal-George Harlow Field, and Plymouth Municipal all have seasonal air cargo operations.

2.6.4 LOGAN AIRPORT

By any measure, Logan International Airport is New England‟s largest transportation center. In 2007, Boston Logan served 28,102,455 passengers – a new airport record – handled 399,537 flights and moved 632 million pounds of cargo, mail and express packages. Logan ranks 19th in the nation in passenger volume and 16th in flight movements based on Airports Council International survey of the top 50 airports. The airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, Massachusetts. There are six runways ranging in length from 2,557 feet to 10,083 feet. The runway layout provides for numerous combinations of runway configurations, and allows a capacity of upwards of 120 operations per hour as shown in Figure 61.

Figure 61: Boston Logan Airport and Surrounding City of Boston



The major freight carriers all operate air cargo facilities at Logan. Major air freight companies include: ABX Air, AirNet Systems, Air Transport International, Federal Express, and United Parcel Service (UPS). On-site freight facilities at Logan are shown in Figure 62 and Figure 63.

Figure 62: North Cargo Area Facilities at Logan Airport

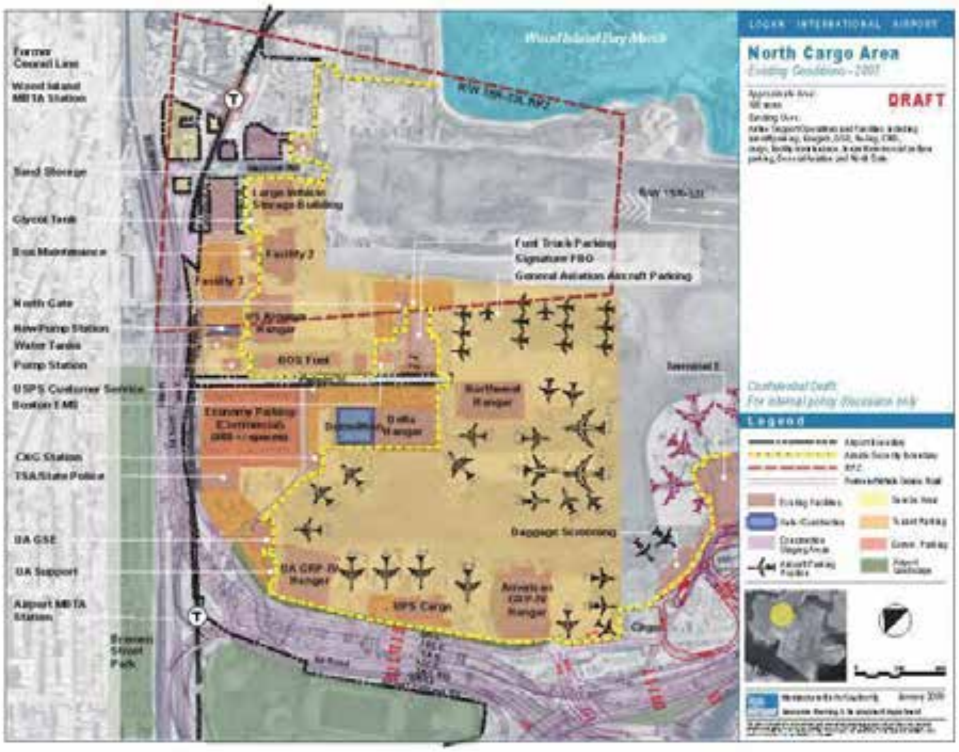
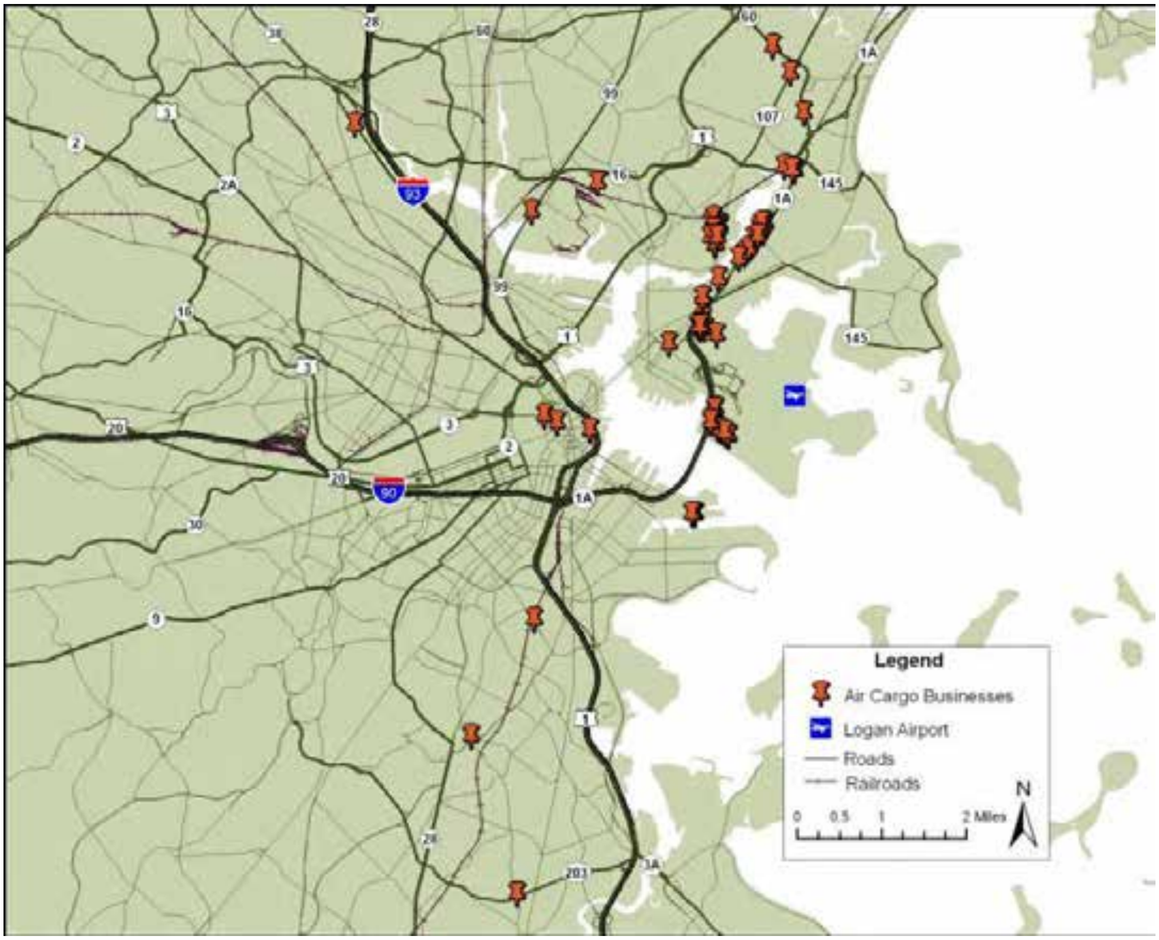


Figure 63: South Cargo Area Facilities at Logan Airport

Surrounding the airport proper are more than 80 air cargo agents, warehouses, and distribution facilities. Located both north and south of the airport, these facilities are located along Route 1A and in Chelsea and Revere to the north, and in South Boston to the south (see Figure 64). Roadway connections are critical for these service providers getting cargo to and from the airport cargo areas. The Chelsea Street truck route, as illustrated in Figure 65, is viewed by the Massachusetts Port Authority (Massport) as a critical infrastructure investment to enhance Logan"s ongoing role as a hub for international and domestic air cargo. This project is illustrative of the issues facing air freight in the region. The airside facilities are adequate to meet the current and projected demands, but growth of the air freight market may be constrained by a combination of roadway congestion and competing land uses. The completion of the Central Artery/Third Harbor Tunnel project has provided significant enhancement to Logan"s ground access, especially from south of the city and the core of the metropolitan area.

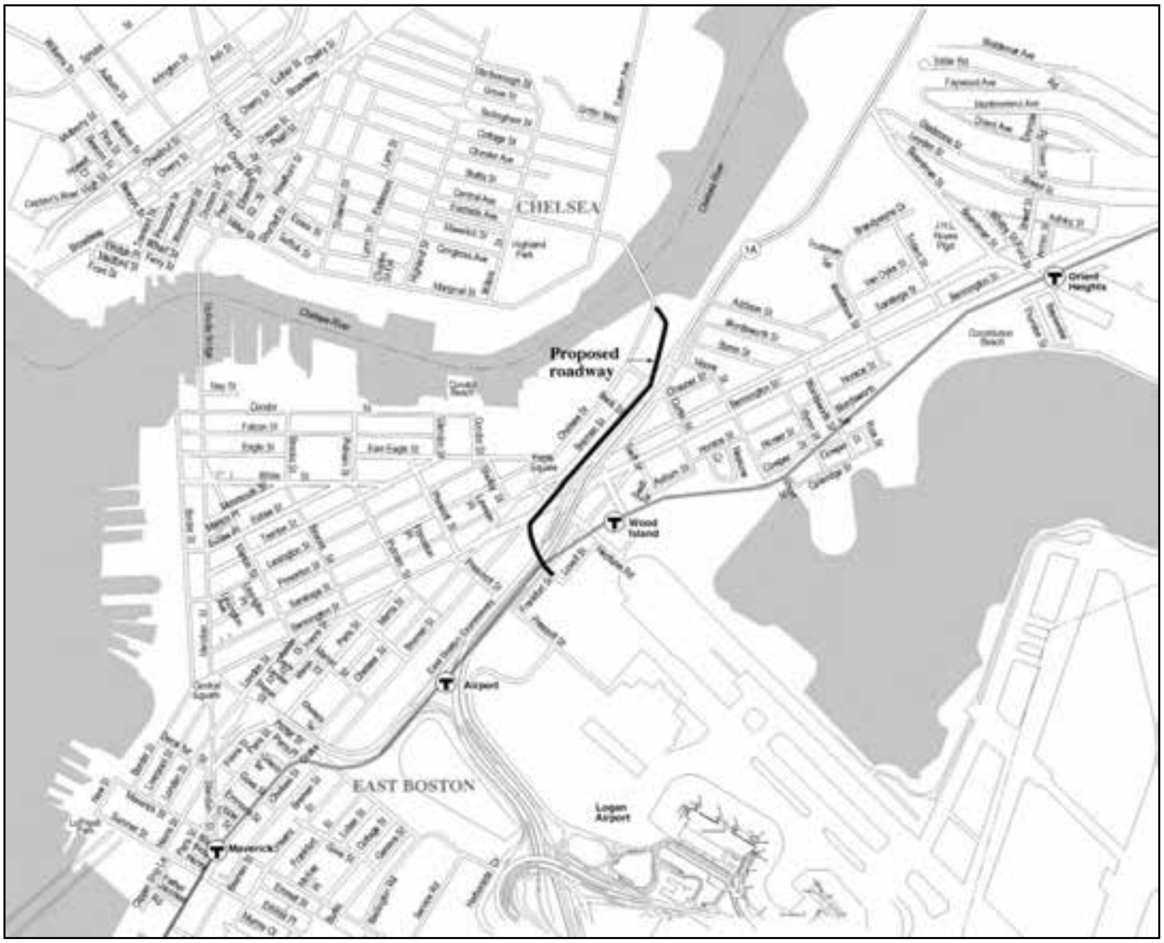
Air freight is viewed as critical to securing new international services at Logan because of its significant contribution to airline profitability. Massport projects that international belly cargo has the potential to reach nearly 25 percent of total tonnage at Logan by 2025.

Figure 64: Sample of Air Cargo Businesses Near Logan Airport



Source: Massport and Google search

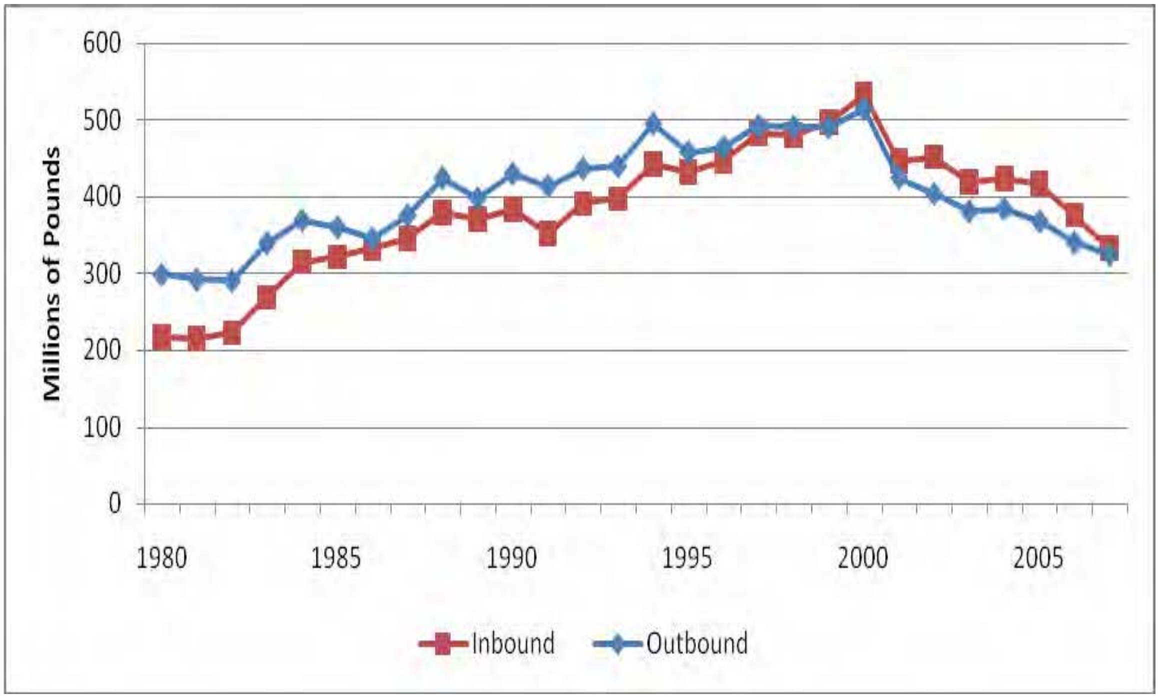
Figure 65: Chelsea Truck Route / East Boston Haul Road—Corridor Location Map



This East Boston Haul Road project would provide improved connections from the Airport and waterfront to the regional highway system while lessening truck traffic on neighborhood streets. The purpose of this road is to divert truck and bus traffic traveling to and from the airport from Chelsea, around the central area of East Boston to the Chelsea Street Bridge. The proposal uses a former railroad right of way to construct this road from the airport, tying into Chelsea Street just before the bridge. Currently, this Haul Road is in the conceptual design phase, and is included in the Boston MPO Regional Transportation Plan.

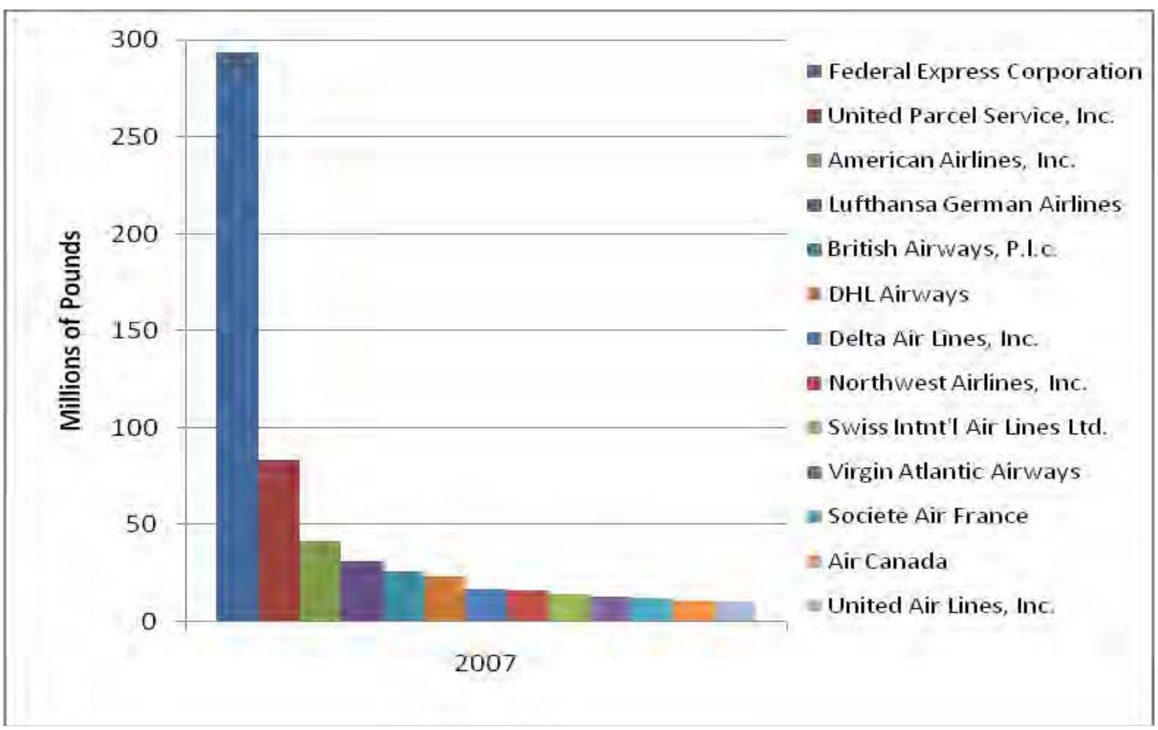
Operations and freight volumes at Logan Airport including the historical trend of air freight pounds handled at Logan from 1980 to 2007, as well as the volume of cargo handled by commercial air provider are the focus of Figure 66 and Figure 67 below. FedEx is by far the largest handler of air freight at Logan, followed UPS, American Airlines, and Lufthansa.

Figure 66: Total Inbound and Outbound Air Cargo, 1980-2007



Source: Massport

Figure 67: Top Air Freight Tonnage by Commercial Airline, 2007



Source: Massport

2.6.5 WORCESTER REGIONAL AIRPORT

Worcester Regional Airport (ORH) provides general aviation and commercial air services to the Greater Worcester Area in central Massachusetts. The airport was sold in May 2010 by the City of Worcester to Massport to have full control over infrastructure and operations.

The Worcester Regional Airport currently provides general aviation services along with a growing commercial passenger service to Punta Gorda and Sanford/Orlando Airports in Florida, and Myrtle Beach, South Carolina. The Airport‟s commercial passenger service peaked in 1989 when there were 354,000 passengers served. In 2001, the Worcester Regional Airport served 143,000 passengers.

Worcester Municipal Airport encompasses 1,300 acres in both Worcester and Leicester. There are two runways, one with precision instrument approach capability at 7,000 feet, and a second for visual approach only at 5,000 feet. The airport has its own on site airport rescue and fire fighting capabilities. The airport property includes an industrial park with truck to truck cargo facilities and distribution businesses. There is potential for the development of air freight operations.

The Airport Master Plan, funded by FAA and MassDOT Aeronautics Division, provides a strategic roadmap for the future development of the airport as current and forecasted demand continues through the twenty-year planning period. Continued community support for the airport, coupled with ongoing marketing strategies for additional scheduled air service and attracting additional based corporate aircraft and aviation related services are key to the airport‟s future growth over the short and long term.

The Worcester Regional Mobility Study has recommended several alternatives for the City of Worcester to consider enhancing its ability to capture business including additional air freight operations. Recommendations include consideration of a rail/transit link from Union Station to the airport and development of the East/West highway corridor option – Hope Avenue/Webster Street/Main Street. The study findings identified the industrial area surrounding the airport as an important economic engine and opportunity for the city and region.[90]

2.6.6 NEW BEDFORD REGIONAL AIRPORT

The New Bedford Regional Airport is located just off Interstate 195 and Route 140 in the Buzzards Bay area of Massachusetts, and offers a range of commercial and general aviation services as well as limited parcel services.

The airport has two paved runways, 5/23 and 14/32. The primary runway, 5/23, is 4998 feet long and 150 feet wide with a full precision approach. The crosswind runway, 14/32, is 5000 feet long and 150 feet wide. Air Traffic Control operates from 7:00 AM until 10:00 PM, seven days a week, and a pilot activated lighting system is available for after hour operations.

Cape Air runs an extensive operation from New Bedford to the islands of Martha‟s Vineyard and Nantucket. Three fixed based operators are on the airfield for all aviation needs, there is a full service restaurant and bar, rental cars, an ATM, and secured parking.

New Bedford Regional Airport has studied the feasibility of lengthening its 5,000 foot runway to 8,000 feet to enable freight for medium and long range cargo aircraft such as the B-757 but this

[90] http://www.vhb.com/worcesterregionalmobility/default.asp

plan has been replaced with a focus on safety and environmental enhancements.[91] This airport provides for shipments of cargo to Martha‟s Vineyard and Nantucket, serving as an alternative to waterborne shipments.

2.6.7 HANSCOM FIELD

L. G. Hanscom Field in Bedford is a full-service general aviation airport, functioning as a general aviation reliever for Logan International Airport. Hanscom handles limited commercial airline and cargo service and is an important resource for Hanscom Air Force Base. Hanscom serves the diverse flying needs of the region‟s high technology corporations and educational institutions. The general aviation component includes business, charter, personal aircraft, air taxi and flight school activity.

In recent years, Hanscom has experienced declines in all types of air traffic except business jets. The small aircraft operators are particularly sensitive to escalating fuel prices. Hanscom‟s regional commuter activity has declined from 160,000 passengers in 2000 to 17,500 today.

Many Hanscom Field facilities were constructed in the 1940s and 1950s and need to be updated. Massport continues to promote third party development of hangar facilities and other infrastructure improvements.

Hanscom will continue to serve as a reliever for Logan International Airport, supporting a wide range of aviation needs. Its excellent airfield and aviation services are widely recognized, and Massport must continue to capitalize on those elements.

2.6.8 BARNSTABLE MUNICIPAL AIRPORT (HYANNIS AIRPORT)

Centrally located in the heart of Cape Cod, Barnstable Municipal Airport is the primary terminal for commercial air transportation in the mid-Cape area. Located just off Route 6, the main highway for cross-Cape travel, and Route 28, Barnstable is easily accessible from any direction. Situated close to Hyannis' Main Street and waterfront, the airport caters to many tourists visiting the region.

The airport has two runways. Runway 15/33 is grooved asphalt, 5,242 feet long by 150 feet wide, and has a precision approach on Runway 15. The second runway, 6/24, is 5,425 feet long, 150 feet wide and grooved as well. Runway 24 has instrument capabilities and there is a PAPI, and VOR, on Runway 6 to aid in approaches to the airport. Both runways have high intensity runway edge lighting and a medium intensity approach lighting system.

Barnstable Municipal offers a variety of services. Jet and 100LL fuels are readily available; airline service and an airport restaurant operate seven days a week. There is an air cargo company on site, flight training, avionics services, and much more.

2.6.9 NANTUCKET MEMORIAL AIRPORT

Nantucket Memorial Airport is located in the heart of historic Nantucket Island. The airport is easily accessible from all points on the island. Scenic beaches and restaurants are all within bicycling distance and taxi service provides connectivity throughout the Island.

The airfield has three runways. Runway 6/24 is paved, 6,303 feet long and 150 feet wide with pilot controlled lighting. The second, Runway 15/33 is paved, 3,999 feet long and 100 feet wide

[91] http://www.newbedford-ma.gov/airport/PROJECTS.html

with pilot controlled lighting. Runway 12/30 is Nantucket's third runway and is 3,125 feet long, 50 feet wide, and also paved. The airport can accommodate single and multi-engine aircraft, as well as corporate jets and helicopters. A control tower operates between the hours of 6:00 AM and 9:00 PM, and until 11:00 PM in the summer months. The airport has a variety of navigational aids including an instrument landing system and VOR, NDB, and GPS approaches.

The Airport provides a full range of airport services. Pilot and passenger services are provided by FBO's. Parking, tie-downs, and Navaids are accessible on a 24 hour basis. Jet and 100LL fuels are available, maintenance, repairs, parts, bulk oxygen, and aviation services can be purchased daily during business hours. Flight instruction and training, rentals and charters, scenic flights, and aerial photography are also available. Pilot lounges and gift shops are available for convenience.

2.6.10 MARTHA'S VINEYARD AIRPORT

Martha's Vineyard Airport is a public airport located in the middle of the island of Martha's Vineyard, three miles south of the central business district of Vineyard Haven. This airport is owned by Dukes County. It is used for both general and commercial aviation.

Martha"s Vineyard Airport covers an area of 688 acres and operates two runways: 6/24 measuring 504 x 100 ft (1,678 x 30 m) and 15/33 measuring 3,297 x 75 ft (1,005 x 23 m). The West Tisbury Police Department is in charge of the security of the airport and the ARFF department is staffed by 10 full-time firefighters.

2.6.11 VOLUME AND SYSTEM CAPACITY

Projections by both Massport and the New England Airport coalition suggest that air cargo at Logan will grow modestly over the next 20-plus years. Currently, express and package services dominate with a 63 percent share of the total tonnage handled. This share is expected to drop to about 60 percent by 2025, with international cargo increasing from 20 percent to 24 percent in the same time frame. Domestic cargo handling is anticipated to decrease to 15 percent, down from 17 percent today (see Table 27).

Air freight is critical to securing new international services at Logan because of its significant contribution to airline profitability. And, attracting air freight to Logan is likewise dependent on increasing international flights. Thus, the capacity to handle more freight is dependent on air services, and the ability to move freight to the airport is dependent on the land side connectivity to and from the region.

Table 27: Logan Air Cargo Tonnage and Share of Cargo by Type: Domestic and International

	Percent of Cargo			Tons (000's)
Years	Domestic Belly	International Belly	Express	Total
2007	17%	20%	63%	287
2015	16%	22%	62%	313
2025	15%	24%	61%	365

Source: Massport

2.6.12 CAPACITY AND CONGESTION AT AIRPORTS, LANDSIDE AIRPORT CONNECTIONS

Air freight consists primarily of high value, low weight commodity shipments. Although only a small fraction of the freight moved in the Commonwealth, it is a critical component of economic competitiveness for the high-tech, high value-added industries in Massachusetts. The major challenges to growth of air freight operations at Logan and other Massachusetts airports include: a) the number of direct service flights to key domestic and international markets; b) the need for improved access to the airports; and c) preserving warehousing and distribution facilities in or near airport facilities.

Improving Freight Access to Airports

Roadway freight access to and from many of the Commonwealth‟s airports is limited for a variety of reasons including poor road access (Worcester), heavy congestion (Hanscom, Logan), and truck route restrictions (Logan). Logan‟s location close to downtown Boston has certain advantages for personal mobility, but presents serious challenges for moving freight through the densely congested routes surrounding the airport. In addition to the benefits of the CA/T project, Massport has engaged in a number of key projects to mitigate these problems, including the development of haul roads and improved truck routes.

Air Freight Warehousing Capacity

Capacity constraints for onsite cargo areas are transferring pressure to nearby freight terminals, resulting in congestion and land use conflicts. There is a need to preserve existing warehouse locations and industrial land at and near airports. This is a problem similar to that of scarce industrial sites served by railroads.

2.6.13 AIRPORT AND AIR FREIGHT ISSUES

2.6.13.1 Logan Airport Regional Access

Air freight forwarders and airline cargo users have identified access to Logan Airport as a key issue since most air cargo companies have moved off airport to surrounding towns and require access to the airport via the regional highway network. These users have expressed concerns regarding highway connections between the North Shore, Chelsea, South Boston, Charlestown, and East Boston, where clusters of air freight forwarders are located. Specifically, the following locations have been identified as bottlenecks in the system:

- Truck queuing on Harborside Drive at Logan Airport;
- Route 1A/ Boardman Street in East Boston;
- Route 1A/ 60/ 16, Mahoney Circle in Revere; and
- Other connections to Route 1 and I-95 in the North Shore.

In addition, airport cargo users identified the following issues with regard to the Ted Williams Tunnel:

- Height limits are posted at 13'-6" rather than 14'-0". Freight forwarder stakeholders suggested that the Tunnel should be posted at 13'-3" to compensate for piles of snow on truck tops that trigger the height alarm at the tunnel entrances. This could help to reduce the number of trucks that cause the alarm to go off, resulting in delays.
- Trailer lengths of 48‟ are allowed in the tunnel, but not two trailers that total 48‟.

2.6.13.2 Worcester Airport Regional Access

Worcester-based focus group participants identified the need for better access to the area airport as well as an improved instrument landing system to enable freight planes to land during fog conditions. The Central Massachusetts Regional Planning Commission is examining this issue and potential improvements in its ongoing Worcester Regional Mobility Study.

2.6.13.3 Air Freight at New Bedford Airport

Southeastern Massachusetts regional meeting participants discussed the planned runway expansion at New Bedford Airport and resulting increase in freight capacity. According to one participant, the Airport is in a Foreign Trade Zone with highway access adequate to handle increased freight. Another attendee believed upgrading the New Bedford Airport is the most important transportation issue in the region because of the positive impact it would have on local businesses. Currently, the MassDOT Aeronautics Division Commission is conducting a study to evaluate opportunities to expand services at this airport.

2.6.13.4 Hazardous Materials

MassDOT maintains and operates the harbor tunnel facilities between Logan Airport and downtown Boston (Sumner, Callahan, and Ted Williams Tunnels) and prohibits the transport of hazardous materials (HAZMAT) through these tunnels in accordance with provisions of 730 CMR 7.05 and 7.10. The regulations define HAZMAT by referring to the term "hazardous material" as defined in 49 CFR parts 171-173 and 177 (1997). Shippers and carriers noted that since the Massachusetts Turnpike tunnels are located in Boston, MassDOT is required to comply with the Boston Fire Department"s prohibition of HAZMATs in tunnels. Inconsistencies between this Boston Fire Department prohibition and the Federal Aviation Administration (FAA) definition of HAZMAT cause problems when a product arrives by airplane, but is prohibited from being transported through a tunnel facility. The example used by the focus group attendees is that the FAA allows the transportation of nail polish remover and similar chemicals on package express airplanes, but trucks carrying this commodity are not permitted through the Ted Williams Tunnel.

2.6.13.5 Landside Connectivity

One constraint for the air freight system is connectivity on the landside transportation routes. This presents a challenge to growing air freight beyond current projections because of the roadway congestion on routes leading to and from airport facilities. Since Logan is the major air freight facility in Massachusetts, the roadway congestion of the metropolitan Boston region can be an impediment to growth of air cargo services in the Commonwealth. A secondary factor, yet related to the roadway congestion issue, is the pressure to relocate distribution and warehousing away from the core of the region – thus imposing additional miles and hours of travel getting products to and from the airport.

2.6.13.6 Safety & Security

Since the September 11, 2001 terrorist attacks, increased levels of safety and security measures have been imposed on all aspects of the aviation industry. The US Department of Homeland Security and the Transportation Security Administration have either promulgated or proposed rules that would impact air cargo services on a national basis – indeed, some rules would have global impacts.

Among rules being considered are:

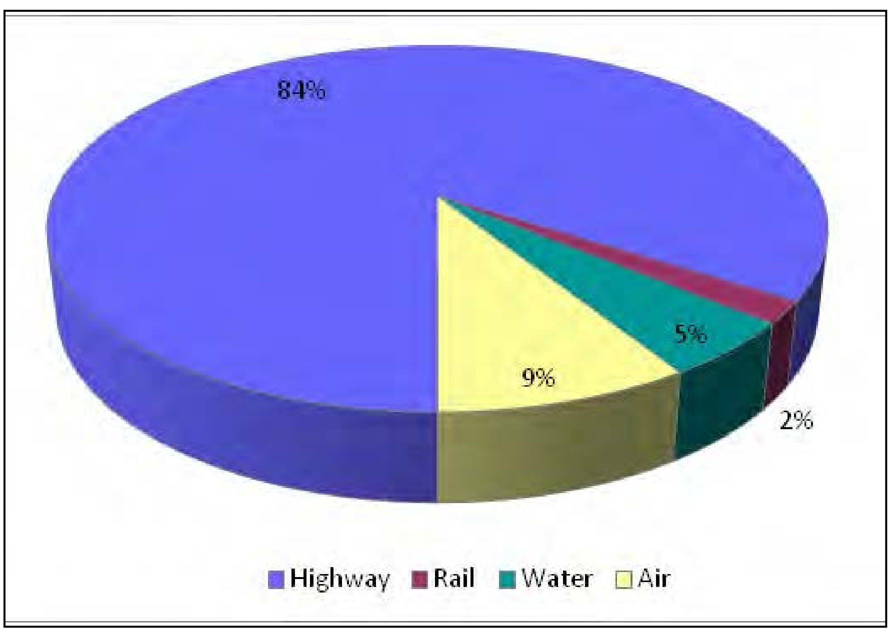
- No cargo in the belly of passenger aircraft;
- 100 percent inspection of belly cargo;
- Partial inspection of belly cargo;
- Sky Marshals on freighters;
- The imposition of a “security fee;”
- Tighter aeronautical access controls;
- Background checks for all workers;
- Physical screening for all workers;
- Extend full security to all-cargo carriers;
- Require the SIDA (Security ID Display Area) to airport cargo areas;
- Extend security requirements to foreign flag carriers and Indirect Air Carriers (IAC).
- Require a percentage of all cargo to be screened; and
- Require employee screening and the vetting of IACs.

If the outcome of the rulemaking is either a restriction on belly cargo or a 100 percent inspection of belly cargo, there would likely be a massive diversion of cargo to trucking and air freighters. Air freight operations are often located away from the major commercial airports, such as Logan, and this could impact the ability of Logan to attract increased levels of international carrier services.

2.6.13.7 Environmental Impacts

In 2007, the transportation industry accounted for 28.5 percent of energy consumed in the United States.[92] Nationally, energy consumed by air transportation modes comprised 9 percent of the nation‟s energy consumption, which amounts to approximately 670 trillion BTUs (Figure 68).

Figure 68: Transportation Energy Consumption Modal Shares

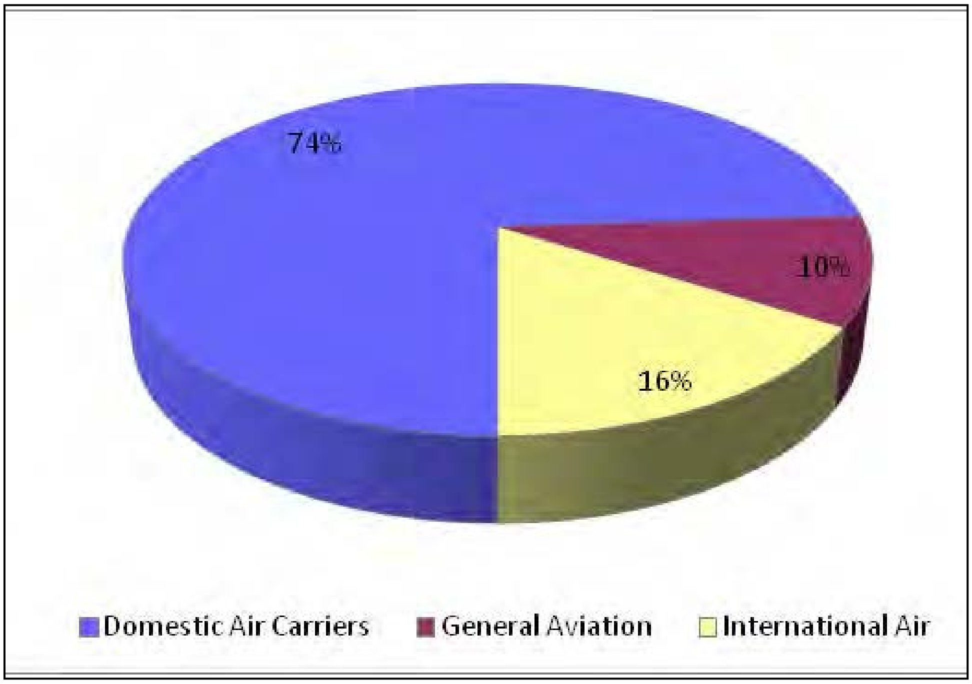


[92] United States Department of Energy, "Transportation Energy Data Book", Edition 27, 2007-2008.

Source: US Department of Energy, Transportation Energy Data Book, Edition 27, 2007-2008

As shown in Figure 69, domestic air carriers consume 74 percent of the energy consumed by air freight carriers, while international carriers consume 16 percent, and general aviation of 10 percent.

Figure 69: Air Carriers Energy Consumption



Source: US Department of Energy, Transportation Energy Data Book, Edition 27, 2007-2008

2.6.14 AIR FREIGHT INDUSTRY OPPORTUNITIES

Air freight provides many of Massachusetts most unique businesses the opportunity to market products worldwide. Specialty agricultural products from central and western Massachusetts are marketed in Europe and Asia. High technology medical devices and pharmaceuticals have global markets. In light of the high value per ton of air freight shipments, increasing the efficiency and cost competitiveness of this mode will have a positive impact on the Commonwealth and regional economy. The identified impediments to such growth include roadway access limitations and restrictions on the growth of land side facilities for handling products close to Logan.

The improvements needed to enhance levels of service to and from Logan have been identified in the regional transportation planning process and many of the key projects have high priority for funding. These projects will benefit not only air freight, but also general traffic flows for both goods and people.

Long sought projects such as the Chelsea Street bridge replacement are now underway, and popular support for haul road projects has increased leading to the likelihood of these projects moving forward. Segregating airport and port freight traffic from general traffic will provide for more efficient goods movement to and from the region, and improve the overall multi-modal opportunities for shippers.

To summarize, the key challenges and opportunities for air freight in Massachusetts are:

- **Critical for Massachusetts Economy –** Air freight is a small but important niche, carrying high-value and highly time-sensitive cargo. As a center of high-value manufacturing and a leader in such "knowledge economy" sectors as biotechnology, pharmaceuticals, and information technology, air freight is critical to the Massachusetts economy. Air freight is projected to grow more quickly than any other mode of goods movement given the structural economic dynamics in the Commonwealth.
- **Landside Access –** While the construction of the Ted Williams Tunnel dramatically improved the utility and accessibility of Logan Airport for air freight operations, congestion of landside connections is still a threat. Other examples of potential highway connectivity improvements to Massachusetts airports include an east-west highway improvement to better serve Worcester‟s airport or the Chelsea Haul Road to Logan.
- **International Air Freight –** More direct international flights through Logan could increase Logan‟s share of air freight volume, to the benefit of the airport, and manufacturers and shippers in Massachusetts.
- **Safety and Security –** Safety and security requirements at airports can impose a time and cost penalty on air freight.
- **Nearby Warehousing and Freight Forwarding –** Competitive air cargo operations requires nearby warehousing and freight forwarding facilities, which currently exist on-site and off-site at Logan Airport. Preserving sites and developable space for this activity in South Boston and the Route 1 and 1A corridors is a top priority for the air cargo industry.

APPENDIX 2-1

NHS - DEFINITION OF TERMS AND CATEGORIES

1. **Centerline Miles** refer to the linear length of a road segment. For divided highways, only the length of one side of the roadway is counted.
2. **Lane Miles** refer to the linear length of lanes of a road segment. For divided highways, the numbers of lanes on both sides of the roadway are counted. Shoulders and auxiliary lanes are not included in the calculation of lane miles.
3. **Jurisdiction** refers to the agency or entity that owns and has administrative authority over the roadway. The Road Inventory file contains 17 different jurisdiction categories. For the purposes of this report, they have been consolidated into ten groups. Please note that unaccepted roads consist of roads open to public travel but not formally accepted by a city or town, as well as some private ways.
4. **Functional Classification** refers to the character of services that a particular roadway is intended to provide. In general, roads either serve to provide mobility for vehicles or access to locations. The process of functional classification was mandated by ISTEA and was completed in 1993 by the Office of Transportation Planning in cooperation with the 13 Regional Planning Agencies. Functional classification divides roadways into the following three general categories:

· *Arterials* provide the highest level of mobility at the greatest vehicular speed for the longest uninterrupted distances and are not intended to provide access to specific locations. Arterials are further subdivided into Principal Arterials and Minor Arterials. However, for the purposes of this report they have been grouped together. Please note that Interstates are considered Arterials, but they have been given their own category in this report.

· *Collectors* provide some level of both mobility and access. They collect traffic from Local roads and funnel it to Arterials. In rural areas, collectors are further subdivided into Major Collectors and Minor Collectors, but for the purposes of this report they have been grouped together.

· *Locals* provide access to abutting land with little or no emphasis on mobility. The term Local road should not be confused with local jurisdiction. Most, but not all, functionally classified Local roads are under city/town jurisdiction.

5. **Aid Category** refers to funding categories that have been established by ISTEA and TEA-21. The Road Inventory directly identifies which roadways fall under the National Highway System Federal Funding category and indirectly identifies which roadways fall under the Surface Transportation Program Federal category and Non-Federal Aid category. These three funding categories are described below:

· *National Highway System (NHS)* funded roadway network represents all Interstate roadways and a systematic network of principal arterials spanning the state. In addition, roadways connecting the NHS roadways with military bases (known as the Strategic Highway Network) are also considered part of the NHS network. NHS passenger and freight terminals are connected by roadways called NHS connectors.

· *Surface Transportation Program (STP)* funded roadway network is comprised of any functionally classified roadway. STP funded roadways include all urban arterials, urban collectors, and rural arterials. According to the TEA-21 legislation, rural collectors are STP-eligible, but have a limitation on the STP funding amount.

· *State and Local Aid* includes chapter 90 and other non-Federal Aid categories. Roadways that fall under this category are comprised of roads functionally classified as local roads.

APPENDIX 2-2

CLASS		AXLES STD.	AXLES VAR.
Permit/ 0	Passenger car, van or motorcycle with Permit/ Commutation Ticket	2	0
1	Passenger car, taxi, ambulance, motorcycle, hearse	2	0
	Light truck or van, 2 axles, 4 tires	2	0
	Tractor, 2 axles	2	0
	Motor home or recreational vehicle, 2 axles, 4 tires	2	0
2	Car, motor home or truck, 4 tires, with 1 axle trailer	3	0
	Tractor, 3 or more axles	3	+1
3	Tractor trailer with 5 or more axles, with 53 ft. trailer (Class 3 + 1 and Class 3)	2	+1, 2
	Tandem trailers (see box below)	2	+1, 2
4	Truck or motor home, 2 axles, 6 tires	2	0
	Bus, 2 axles, 4 tires	2	0
	Car, motor home or truck, 4 tires, with 2 axle trailer	2	+2
5	Tractor trailer with 5 or more axles	5	+1, 2
	Stinger steered auto transporter 5 or more axles, greater than 65 but not exceeding 75 feet	5	+1, 2
	Truck or tractor, 2 or more axles, with triple saddlemount	5	+1, 2
6	Tractor trailer, 3 axles	3	0
	Auto transporter, 3 axles	3	0
	Car, motor home or truck with 4 tires, 3 axle trailer	3	+2
	Tractor-mobile home comb. with 4 axles	3	+1
	Truck or motor home, 2 axles, 6 tires with 2 axle trailer	3	+1

CLASS		AXLES STD.	AXLES VAR.
6 (cont'd.)	Bus with 3 axles	3	0
	Truck or tractor, 2 axles, with double saddlemount	3	+1
	Tractor, 3 axles, with single saddlemount	3	+1
7	Tractor trailer, 4 axles	4	0
	Auto transporter, 4 or more axles	4	+1,2
	Stinger steered auto transporter 4 or more axles not to exceed 65 feet	4	+1,2
	Tractor-mobile home comb. with 5 or more axles	4	+1,2
	Motor home or truck, 2 axles, 6 tires with 3 or more axle trailer	4	+1,2
	Motor home or truck, 3 axles with 1 or more axle trailer	4	+1,2
	Bus or truck with 4 or more axles	4	+1
	Truck or tractor, 3 axles, with double saddlemount	4	+1
	Truck, 3 axles, with single saddlemount	4	0
	Tandem trailers (see box below)	4	-1 +1,2
8	Truck, 3 axles	2	+1
	Tractor, 2 axles, with 1 axle mobile home	2	+1
	Motor home, 3 axles	2	+1
	Motor home or truck, 2 axles, 6 tires with 1 axle trailer	2	+1
	Bus, 2 axles, 6 tires	2	0
	Truck or tractor, 2 axles, with single saddlemount	2	+1
9	NON-REVENUE VEHICLES	2	-1 +1

TANDEM TRAILERS: Trailers over 28.5 feet are Class 7. Trailers 28.5 feet and under are Class 3.

- Tractor with two long trailers (Class 7 and Class 7 - 1)
- Tractor with 1 long, 1 short trailer (Class 7 and Class 3)
- Tractor with 2 short trailers (Class 3 + 1 and Class 3)
- Dolly and semi (over 60 ft. total) hauled by single-unit truck (Class 7 and proper Class for truck)

APPENDIX 2-3: EXISTING FREIGHT RAILROAD YARDS AND FACILITIES IN MASSACHUSETTS

City/Town	Name of Facility	General Function	Other Information
Pan Am Railroad (Boston & Maine)			
Boston/Somerville	Valley area	Merchandise Freight	Former B&M yards in Boston no longer exist. PAR/PAS currently uses tracks behind CRMF for one local freight train serving area. Cars for Boston Sand & Gravel handled directly to their facility
Lawrence	Lawrence Yard	Merchandise Freight	PAR/PAS yard in northeastern Mass.
Lowell	Turnout Yard	Merchandise Freight	Several tracks near Gallagher Transportation Center used for block swapping and local freight
North Billerica	Shop Yard	Merchandise Freight	A number of consignees use various tracks in the old yard where the former B&M shops are located
Ayer	PAS Auto Site	Automotive	Inactive. Leased by CSXI, but CSXI moved traffic to Framingham, CP Yard
Ayer	Hill Yard	General Freight	Supports, intermodal and merchandise traffic
Ayer	Intermodal Yard	Intermodal	Intermodal terminal handling mostly containers and some trailers
Ayer	SanVel Site	Potential Automotive	Possible future use as an auto unloading facility. Formerly used to load concrete ties, unused for years.
Lunenburg	East Fitchburg Yard	Merchandise Freight	Primarily plastic resin transload and some local freight
Gardner	Gardner Yard	Merchandise Freight	Interchange with Providence and Worcester RR
Deerfield	East Deerfield Yard	Merchandise Freight	Major classification yard, locomotive servicing, work equipment and repair tracks
Holyoke	Mt. Tom Plant	Northeast Utilities Coal Yard	Coal yard for receiving unit trains of coal for Northeast Utilities Mt. Tom Generating Station
CSX			
Everett/Chelsea	NEP Yard	Merchandise Freight	Small yard supporting local customers, including Boston Market Term. & New England Produce Center
Boston-Allston	Beacon Park Yard	Intermodal	Intermodal terminal handling both trailers and containers
Boston-Allston	Beacon Park Yard	Merchandise Freight	Includes bulk Trans-flo facility (mostly sweeteners and edible oils) and

			general freight
Boston-Allston	Beacon Park Yard	Solid Waste Transfer	Transfers solid waste in sealed containers from truck to rail. Mostly commercial waste
Boston-Allston	Beacon Park Yard	Locomotive Servicing Tracks	Basic locomotive servicing and freight car running repairs
Boston-Readville	Readville Yard	Merchandise Freight	Supports local freight distribution along Northeast Corridor and connecting lines
Middleborough	Middleborough Yard	Merchandise Freight	Supports local freight distribution in southeastern Massachusetts, and Mass Coastal interchange
Braintree	S. Braintree Yard	Merchandise Freight	Storage and Interchange with Fore River Railroad
Framingham	North Yard	Merchandise Freight	Supports local freight distribution in eastern Massachusetts
	Nevins Yard	Merchandise Freight	Supports local freight distribution in eastern Massachusetts
	Auto Facility	Automotive	Unloads auto carriers to truck for distribution
	CP Yard	Automotive	Supports Auto facility and also used for storage
Walpole	Walpole Yard	Merchandise Freight	Small yard to support local freight distribution in east central Massachusetts
Westborough	Auto Facility	Automotive	Currently inactive-auto business moved to East Brookfield. Used for storage and local service
Worcester	Worcester Yard	Intermodal	Intermodal terminal handling mostly trailers - major user is United Parcel Service
Worcester		Transloading Terminal	Transfers plastic resins (pellets) from rail car to trucks, operated by Delaware Express
East Brookfield	Auto Facility	Automotive	Major auto unloading facility replacing Westborough and most of Framingham
Palmer	Palmer Yard	Merchandise Freight	Small yard used for interchange to New England Central RR and Massachusetts Central RR
West Springfield	W. Springfield Yard	Merchandise Freight	Supports local freight distribution and interchange to Connecticut Southern Railroad
West Springfield		Intermodal	Intermodal terminal handling both trailers and containers
Fall River	Fall River Yard	Merchandise Freight	Small yard near the State Pier used for switching several consignees in the area
New Bedford	New Bedford Yard	Harbor clean-up operation	Rebuilt yard support potential business and to allow moving by rail dredged soil from harbor clean-up operation

Pittsfield	North Adams Junction	Merchandise Freight	Yard for local service and interchange with HRRC
Providence and Worcester Railroad			
Worcester	South Worcester Yard	Merchandise Freight	General freight yard includes locomotive service and repair facility as well as car repair
Worcester	Stockbridge	Intermodal	Intermodal terminal handling containers - mostly international - operated by Intransit Container
Worcester	Wiser Avenue	Intermodal	Intermodal terminal handling containers - mostly international - operated by Intransit Container
Worcester	Greenwood Yard	Transloading Terminal	Transfers various dry and liquid bulk commodities to truck for local distribution
New England Central Railroad			
Palmer	Palmer Yard	Merchandise Freight	General freight yard for local distribution
Massachusetts Central Railroad			
Palmer	Palmer Intermodal	Freight	General Freight Yard
Ware	Ware Yard	Transloading Terminal	Bulk transfer facility, mostly plastic resins
Pioneer Valley Railroad			
Westfield	Westfield Yard	Merchandise Freight	General freight yard for interchange with CSX and local distribution
		Transloading Terminal	Bulk transfer facility, mostly plastic resins
Housatonic Railroad			
Pittsfield	North Adams Junction	Merchandise Freight	HRRC access to CSX yard for interchange with CSX and local distribution

Fore River Railroad			
Quincy	Fore River Yard	Merchandise Freight	Small yard at old ship yard area used to serve Twin River Technology plant and MWRA fertilizer
Grafton & Upton Railroad			
Grafton	North Grafton Yard	Merchandise Freight	Small yard for CSX Interchange and transload operation

APPENDIX 2-4

Rank	City/Town	Route	Feature Intersected	Daily Traffic
1	Lynnfield	Newburyport Turnpike	I 95 /ST128	156,700
2	Lowell	I 495 NB	RR BMRR	130,000
3	Lowell	I 495 SB	RR BMRR	130,000
4	Bedford	HWY PAGE RD	Shawsheen River	123,100
5	Lowell	I 495 SB	Concord River	110,000
6	Boston	I 90 WB	Beacon St.	105,465
7	Boston	I 90 EB	Brooks St.	105,465
8	Boston	I 90 WB	Brooks St.	105,465
9	Newton	I 90	RR CSX/MBTA	105,465
10	Cambridge	Memorial Dr.	Brookline St.	100,000
11	Hopkinton	I 495 SB	W. Main St.	98,909
12	Worcester	I 290 EB	Mckeon Rd.	98,000
13	Danvers	ST 128	Waters River	97,500
14	Newton	I 90	RR CSX/MBTA	92,541
15	Chelsea	US 1	HWY Arlington & 5TH ST	90,000
16	Chelsea	US 1 S ABT,PR1	HWY ARLINGTON & 5TH ST	90,000
17	Southborough	I 495 NB	Northboro Rd.	90,000
18	Needham	Highland Ave.	I 95 SB/ST 128 SB	89,400
19	Concord	Concord Turnpike	Sudbury River	89,100
20	Wellesley	I 95 NB/ST128 NB	Worcester St.	86,000
21	Chelsea	US 1	Spruce St.	83,000
22	Hanover	NB Pilgrim Highway	Webster St.	82,000
23	Amesbury	I 95	Merrimack River	80,000
24	Hopkinton	I 495 NB	W. Main St.	77,000
25	Fall River	I 195	ST 79 & Taunton River	75,400
26	Littleton	I 495 NB	ST 2	75,000
27	Littleton	I 495 SB	ST 2	75,000
28	West Bridgewater	ST 24	Town River	75,000
29	West Bridgewater	ST 24	S. Elm St.	75,000
30	Methuen	Broadway	ST 213	72,000
31	Boston	Morrisey Boulevard	Neponset Ave. & River	70,700
32	Stoughton	Lindelof Ave.	ST 24	70,200
33	Danvers	ST128	RR MBTA/BMRR	70,000
34	Everett	ST 16 REV BCH PKWY	Malden River	70,000
35	Westborough	I 90 EB	RR CSX	68,385
36	Westborough	I 90 WB	RR CSX	68,385
37	Westborough	I 90 EB	Flanders Rd.	68,385
38	Westborough	I 90 WB	Flanders Rd.	68,385
39	Boston	I 90 WB	RR CSX	63,725
40	Rockland	SB Pilgrim Highway	Hingham St.	63,000
41	Boston	I 90 EB	RR CSX	62,904
42	Framingham	Worcester Rd.	Reservoir Outlet	58,800
43	Boston	ST 28	Charles River	58,000
44	Dedham	Providence Highway	Harris St.	58,000
45	Boston	STORRW DR WB	STORROW DR EB	57,770
46	Dedham	Providence Highway	Mother Brook	57,500
47	Gloucester	ST 128	Annisquam River	57,160
48	Auburn	I 90 EB	Oxford St.	57,041
49	Auburn	I 90 WB	Oxford St.	57,041
50	Haverhill	Bridge St.	RR BMRR (ABANDONED)	55,700

Rank	City/Town	Route	Feature Intersected	Daily Traffic
51	Amesbury	I 495 NB	RR BMRR (ABANDONED)	55,100
52	Boston	Morrissey Boulevard	Patton Cove	54,000
53	Norwell	ST 3 NB	High St.	53,000
54	Weston	I 90 RAMPS J & L	MDC Aqueduct	52,911
55	Framingham	ST 9 /ST 30/	Sudbury River	52,200
56	Boston	Alford St.	Mystic River	52,000
57	Dartmouth	FNCE CRNR RD	I 195	52,000
58	Somerville	Mcgrath Highway	Gilman St.	50,000
59	Seekonk	ST 114 A	I 195	49,700
60	Boston	Cambridge St.	ST 3 & Charles River	49,500
61	Boston	ST 28 CHAS R DM RD	Charles River	49,500
62	Fall River	Brightman St.	Taunton River	49,000
63	West Bridgewater	W. Center St.,	Hockomock River	49,000
64	Hanover	Washington St.	Pilgrim Highway	48,800
65	Lowell	ST 110 / ST 38	Merrimack River	48,000
66	Attleboro	Newport Ave.	RR AMTRAK/MBTA	47,400
67	Shrewsbury	Belmont St.	Lake Quinsigamond	45,200
68	Boston	American Legion Highway	Morton St.	45,000
69	Boston	Morrissey Blvd.	Mt. Vernon St.	44,300
70	Revere	REV BCH PKWY	RR MBTA/BMRR	44,000
71	Haverhill	Bridge St.	Merrimack River	43,200
72	Lexington	ST 2 EB	I 95 /ST128	42,000
73	Medford	Main St.	Mystic River	42,000
74	Newton	Service Rd.	Charles River	42,000
75	Duxbury	Pilgrim Highway	Franklin St.	41,700
76	Salem	North St.	North River	41,500
77	Boston	Morton St.	RR MBTA	41,300
78	Revere	Broadway	Diamond Creek	41,100
79	Boston	Brookline St.	SOL FLD RD & river	41,000
80	Boston	Chelsea St.	Chelsea River	40,400
81	Harvard	I 495 SB	Stow Rd.	40,000
82	New Bedford	I 195 EB	ST140	40,000
83	Hudson	Washington St.	Assabet River	39,200
84	Leominster	N. Main St.	ST 2	39,000
85	Boston	N. Washington St.	Charles River	38,400
86	Framingham	Main St.	Worcester Rd.	38,300
87	Dennis	ST 134	US 6 WB/Mid Cape Highway	37,800
88	Revere	Salem Turnpike	Water Pines River	37,400
89	New Bedford	I 195 WB	ST140	37,000
90	Quincy	Hancock St.	SGMRE ST&MBTA&REDS	36,500
91	Dennis	Main St.	Swan Pond River	36,100
92	Boston	Granite Ave.	Neponset River	36,000
93	Boston	Mystic Ave.	Orange & MBTA/BMRR	35,600
94	Swansea	US 6 GAR HWY	I 195	35,100
95	Saugus	Salem Turnpike	Pines River	35,000
96	Springfield	US 5 SB	I 91	34,722
97	Freetown	ST 24	Main St.	34,500
98	Westfield	Elm St.	Westfield River	33,900
99	Boston	ST203 MONSGR CASEY	WASH ST&AMTK&ORNG	32,600
100	Chelmsford	North Rd.	I 495	32,500

REFERENCES

Massachusetts Rail *Trends and Opportunities*, Mass. EOT&PW, July 2007, updated by project team.

AREMA Manual for Railway Engineering.

US Department of Transportation Federal Highway Administration – National Bridge Inventory (NBI) http://www.fhwa.dot.gov/Bridge/nbi.htm

3 Trends and Future Conditions

This section of the Freight Plan presents the economic, trade, and land use development trends and future conditions related to goods movement in Massachusetts. The analysis covers both historical trends as well as a 20 to 30 year long-term planning and forecast horizon. It is based on the most current economic and trade data available at the time of the analysis. Consequently, it was compiled mostly prior to the full effects of the national and global economic recession. However, given the study's long-term horizon, the long-term trends, issues, and forecasts are considered valid and not significantly affected by the immediate economic conditions. Where appropriate, such as the freight volume forecasts from the data source provider, effects of the economic recession were considered.

3.1 ECONOMIC TRENDS AND CONDITIONS

This section on economic trends and conditions provides an overview of the economy of Massachusetts across all industries. The first segment of this section includes consideration of regional economic trends and key indicators such as personal income and export trade data, which directly relate to our demand for goods movement. The second segment of this section is focused on the role of freight in the Commonwealth's economy in terms of both direct economic activity as well as the transportation needs and dependency of key industries throughout the Commonwealth.

3.1.1 MASSACHUSETTS ECONOMIC OVERVIEW AND TRENDS

3.1.1.1 Overview

The freight industry in the Commonwealth of Massachusetts has historically been a vital component of the Massachusetts economy. The freight and transportation industries in Massachusetts are responsible for moving both goods and passengers throughout New England, maintaining connections and links with the rest of the US, and reaching global markets. An efficient multi-modal freight system is essential for the full-range of industries in Massachusetts that receive bulk products by rail or sea, and ship high-value goods and parcels domestically and internationally.

Although Massachusetts has a robust, multimodal transportation system, this infrastructure is some of the oldest within the US. The age and condition of much of this infrastructure represents a challenge to maximizing the effectiveness of the transportation system, which in turn could restrict the economic potential of the Commonwealth.

The Commonwealth's economic value-added (gross state product) has exhibited slightly faster growth in the last decade than the nation as a whole and is among the states leading the way out of recession. Massachusetts is the most populous state of New England, and in terms of per capita personal income, Massachusetts is third[1] in the nation making Massachusetts a very strong consumer market. Considering Massachusetts' growth trends, and the need for efficient transportation of goods and people, strategic infrastructure investment will likely be necessary to at maintain and improve the transportation system.

[1] 2007 US Census Bureau and Bureau of Economic Analysis.

3.1.1.2 Massachusetts Sub-state Regions

The Commonwealth of Massachusetts has 14 counties, and for the purposes of the Freight Plan, the Commonwealth was segmented into seven different regions. These regions are:

- **Berkshire –** Berkshire County
- **Pioneer Valley –** Hampden, Hampshire and Franklin Counties
- **Central –** Worcester County
- **Greater Boston –** Middlesex, Norfolk and Suffolk Counties
- **Northeast –** Essex County
- **Southeast –** Bristol and Plymouth Counties
- **Cape & Islands –** Barnstable, Dukes and Nantucket Counties

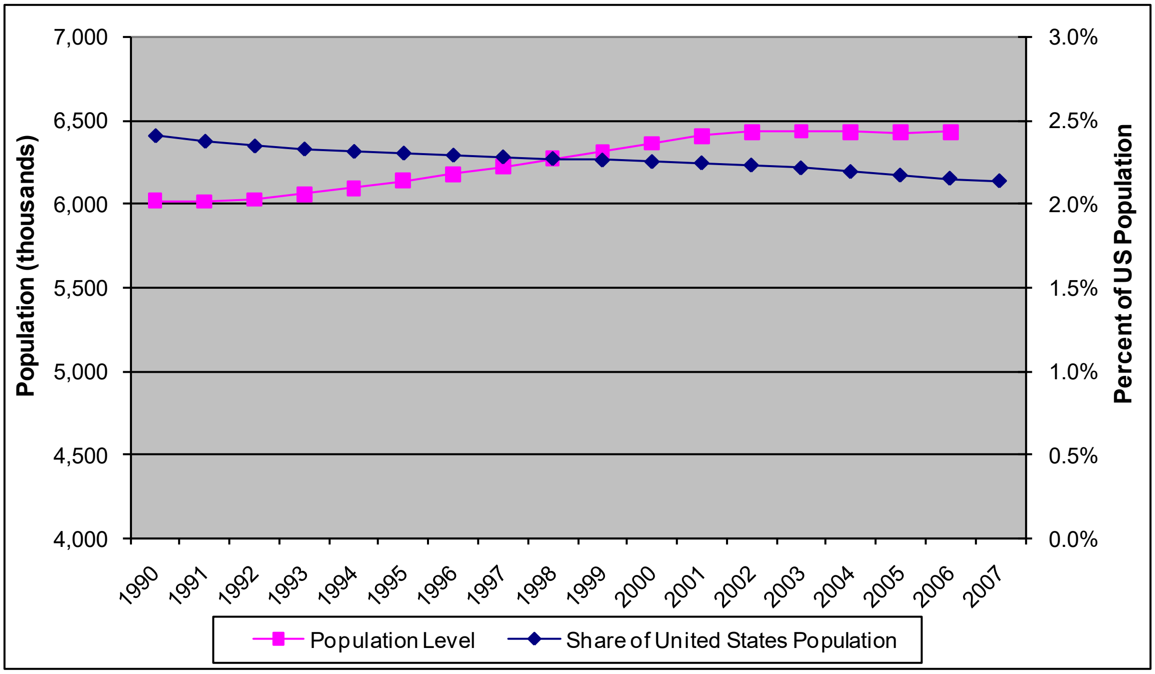
Because economic and demographic data (including forecasts) is primarily provided at the county level, it was determined that any sub-state analysis should be at the county-level.[2] This regional configuration was chosen for consistency with recent regional economic analysis and planning such as that recently led by the Executive Office of Housing and Economic Development.[3]

3.1.2 DEMOGRAPHIC TRENDS

As of 2007, the US Census Bureau estimates that there are more than 6.4 million people living in Massachusetts. Although the Massachusetts population is exhibiting modest growth, 3.59 percent from 1997 to 2007, it is not growing as rapidly as the nation and thus is declining in terms of its share of United States population (Figure 1). As of 1990, residents of Massachusetts comprised 2.4 percent of the US population, and by 2007 this share declined to 2.1 percent. The overall growth trend can be seen in Figure 2 where Massachusetts is growing but at a much lower rate than the nation (the ―jump" in population in 2000 is reflective of the 2000 Census adjustment).

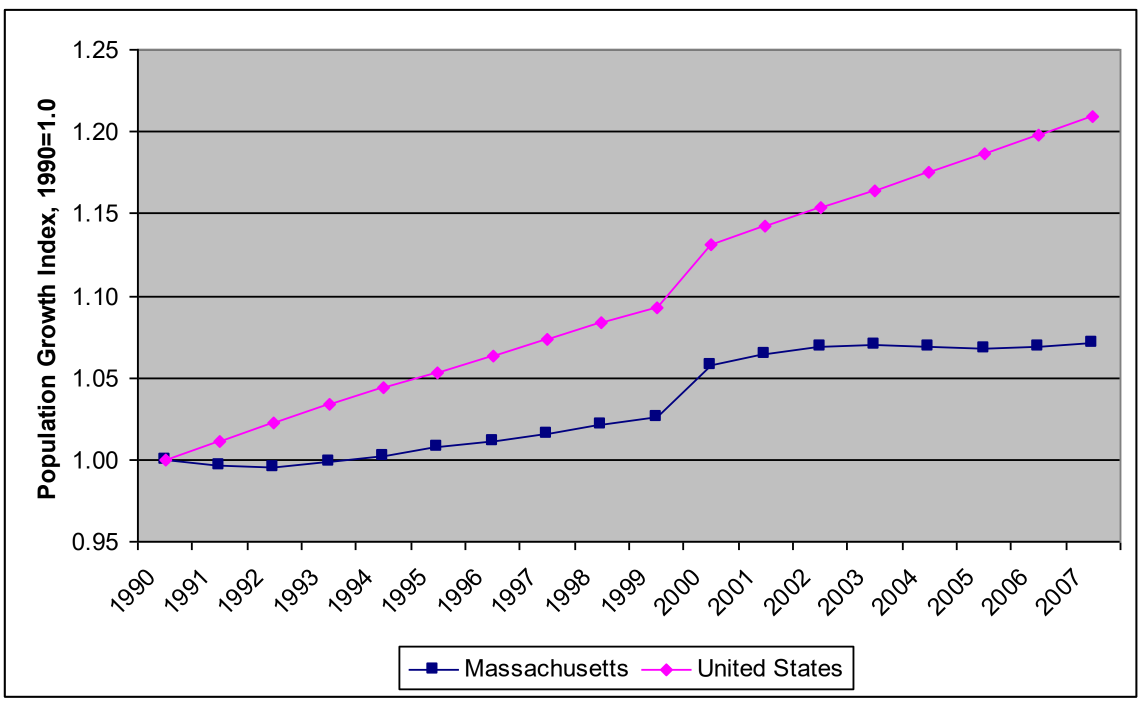
[2] We recognize that there are other regional definitions such as the configuration of metropolitan planning organizations (MPOs) and regional planning agencies (RPAs). Unfortunately, those regional configurations do not strictly follow county lines, and thus would be difficult to implement for this data-driven component of the freight plan.
[3] http://www.mass.gov/Ehed/docs/EOHED/Economic_Framework/Framework_FINAL.pdf

Figure 1: Massachusetts Population and the Massachusetts Share of the Total US Population



Source: Bureau of Economic Analysis, downloaded June 2008

Figure 2: Historical Population Growth in Massachusetts and the US, 1990-2007



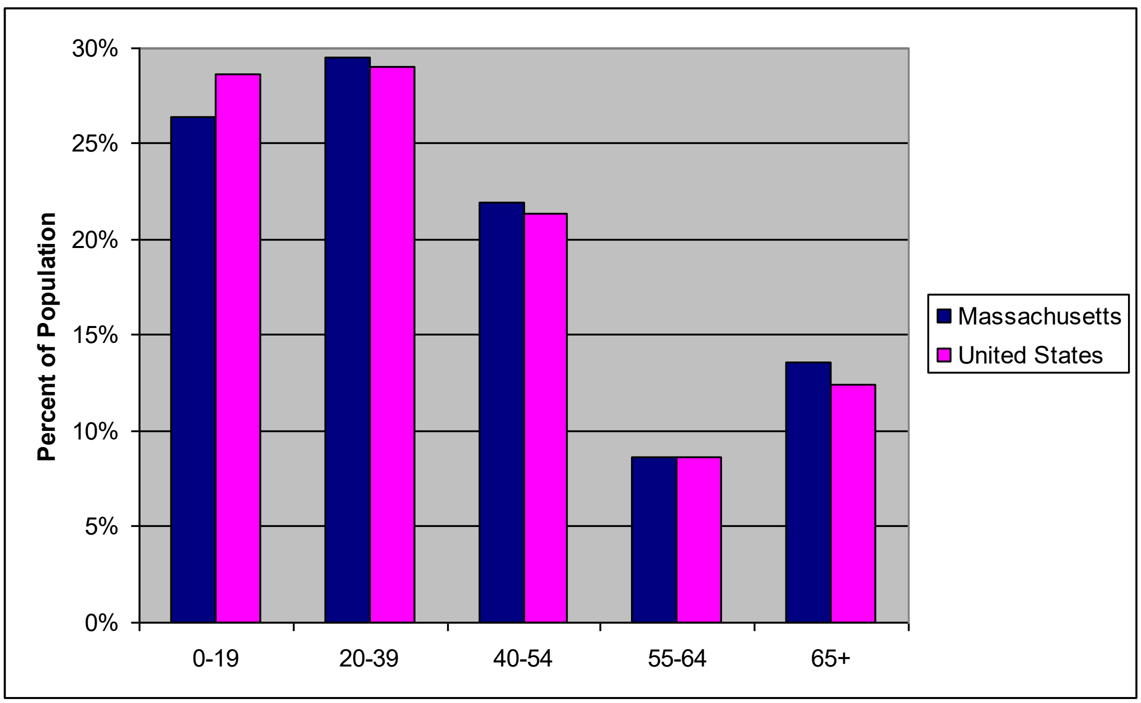
Source: Population Estimates Program, Population Division, US Census Bureau

The age composition of residents in Massachusetts also differs from the national average, as seen in Figure 3. According to the US Census Bureau, the median age in Massachusetts is

38.2 while the median age for the United States is only 36.6. In addition, the older age groups are growing faster than the younger age groups, consistent with an aging population. The proportion of young people aged 0-19 in Massachusetts is 1.5 percentage points lower than the rest of the US, while the age group over 65 years old is projected to grow from 13.2 percent of the Commonwealth population in 2007 to more than 20 percent by 2030, slightly higher than the 19.6 percent expected for the US as a whole. Massachusetts does have a higher share of its population in the 20-54 age groups, which benefits Massachusetts by providing a relatively large number of workers and a balance to the transportation service needs of children and seniors.

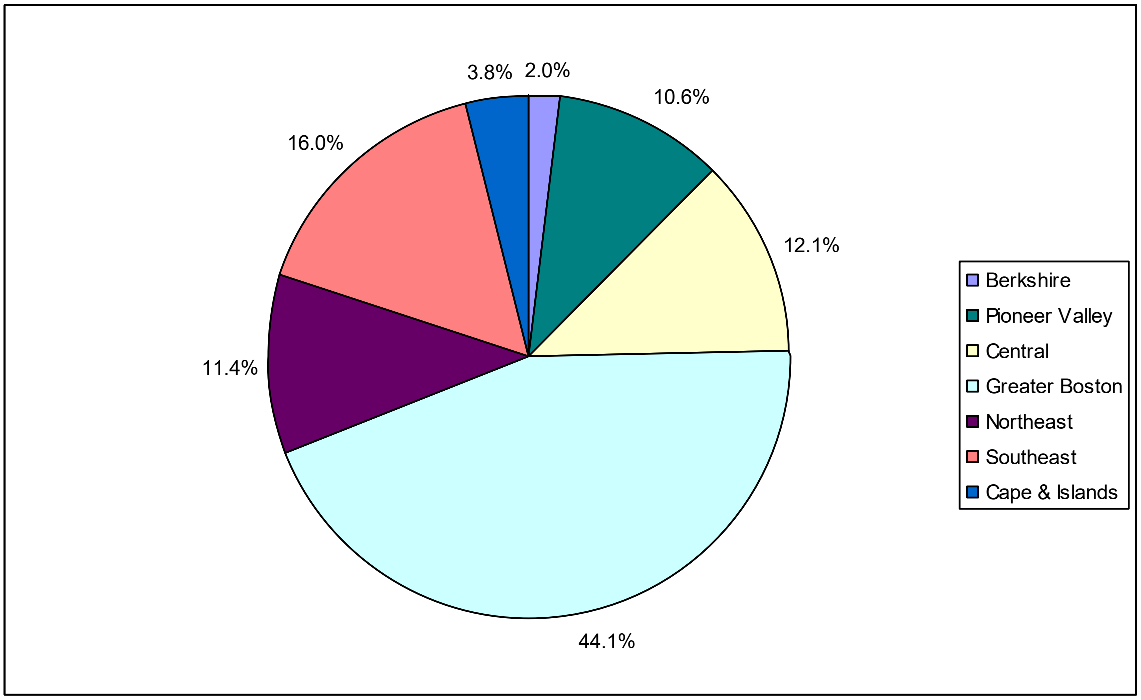
The population of Massachusetts is heavily concentrated in the eastern part of the Commonwealth, with more than 75 percent living in the four regions (nine counties) that comprise eastern Massachusetts. Forty-four percent of the total population lives in greater Boston (Figure 4). Of the 13 largest incorporated cities in Massachusetts (70,000 or more population), Worcester and Springfield are the only two in the region that are not located in the eastern portion of Massachusetts. The high population densities in the eastern portion of the Commonwealth have obvious implications for congestion, demand for freight and goods, and other transportation infrastructure issues.

Figure 3: Comparison of Massachusetts and US Populations by Age Group as of the 2000 Census



Source: US Census Bureau, Population Division, Census 2000 Data

Figure 4: Share of Estimated Population by Region of Massachusetts, 2007



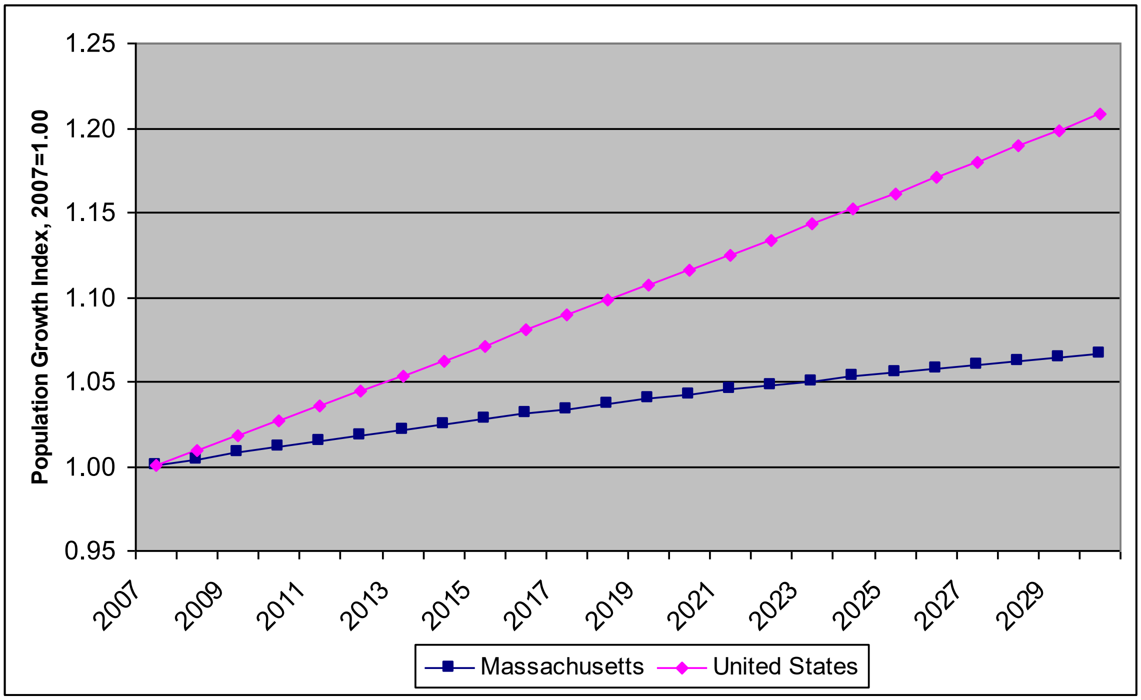
Source: US Census Bureau, Population Estimates Program, downloaded June 2, 2008

3.1.2.1 Demographic Forecast

The Census Bureau estimates that between 2000 and 2030, the population of Massachusetts will grow by 10.4 percent while the US population is anticipated to continue growing more rapidly: by 29.4 percent over that time period (Figure 5). The rapid growth of the over 65 population is expected to continue, increasing the median age within Massachusetts to 40.2 years old, 1.2 years older than the projected national average.

At the regional level, Berkshire is the only region expected to show a population decline over the next 20 years (Table 1). The northeast and southeast regions of Massachusetts experienced the strongest growth in the Commonwealth between 1990 and 2000, growing eight and seven percent respectively. This growth was consistent with national trends; however, these regions are expected to grow at half that rate through 2020.

Figure 5: Forecast of Population Growth Trends in the US and Massachusetts, 2007 Estimate through 2030



Source: US Census Bureau, Population Division, Interim State Population Projections, 2005

Table 1: Total Population by Region, Historical for 1990 and 2000 and Forecast for 2010 and 2020

	Historical		Forecast		Growth Rate	
	1990	**2000**	**2010**	**2020**	**2000-2010**	**2010-2020**
Berkshire	139,352	134,953	126,255	118,452	-6.4%	-6.2%
Pioneer Valley	672,970	680,014	684,299	690,154	0.6%	0.9%
Central	709,705	749,965	793,336	843,534	5.8%	6.3%
Greater Boston	2,678,461	2,806,509	2,860,156	2,898,745	1.9%	1.3%
Northeast	670,080	723,419	754,724	787,032	4.3%	4.3%
Southeast	941,601	1,007,500	1,050,177	1,094,512	4.2%	4.2%
Cape & Islands	204,256	246,737	288,054	335,283	16.7%	16.4%

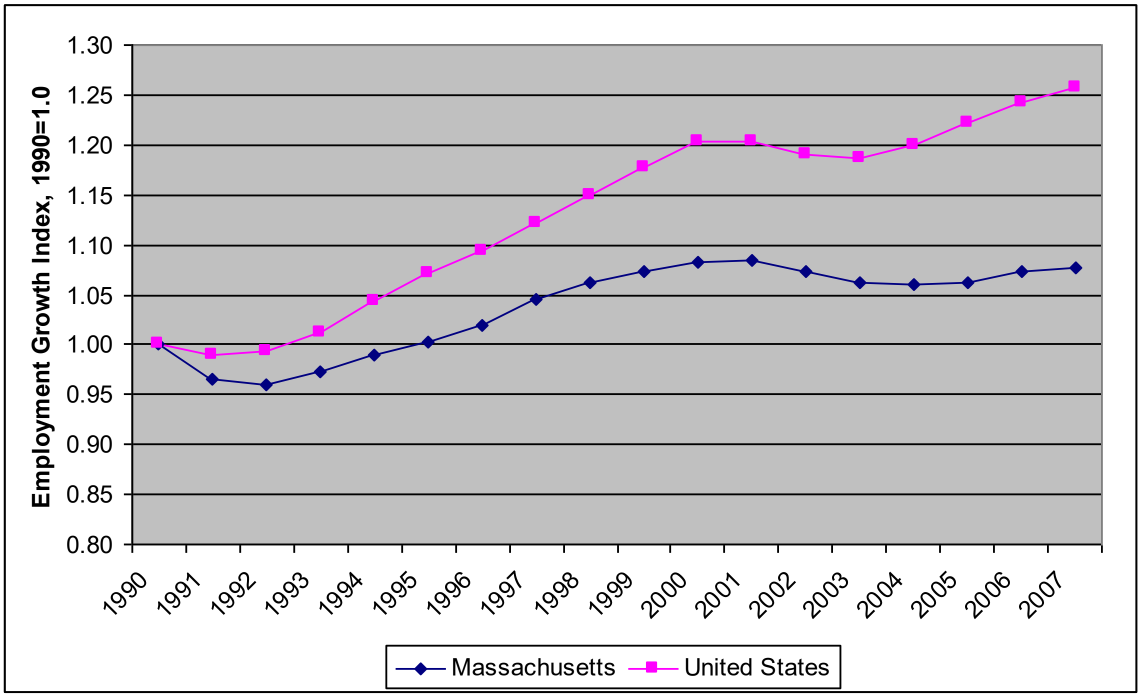
Source: Massachusetts Institute for Social and Economic Research

3.1.3 ECONOMIC TRENDS

3.1.3.1 Total Employment

In 2007, there were 3.26 million jobs in Massachusetts accounting for 2.4 percent of all US employment. From 1990 to 2007, 233,200 jobs were added to the Massachusetts economy, representing eight percent growth over the entire period (Figure 6). This job growth trails the US trend over the same period. While Massachusetts experienced overall positive growth from 1990 to 2007, there were two short periods where employment declined: in the early 1990's and from 2002 to 2004. Both were consistent with national trends, as total employment declined in 2002 and 2003 throughout the US. Massachusetts is leading the US out of the 2008-2010 economic recession, which created a significant loss of jobs throughout the country.

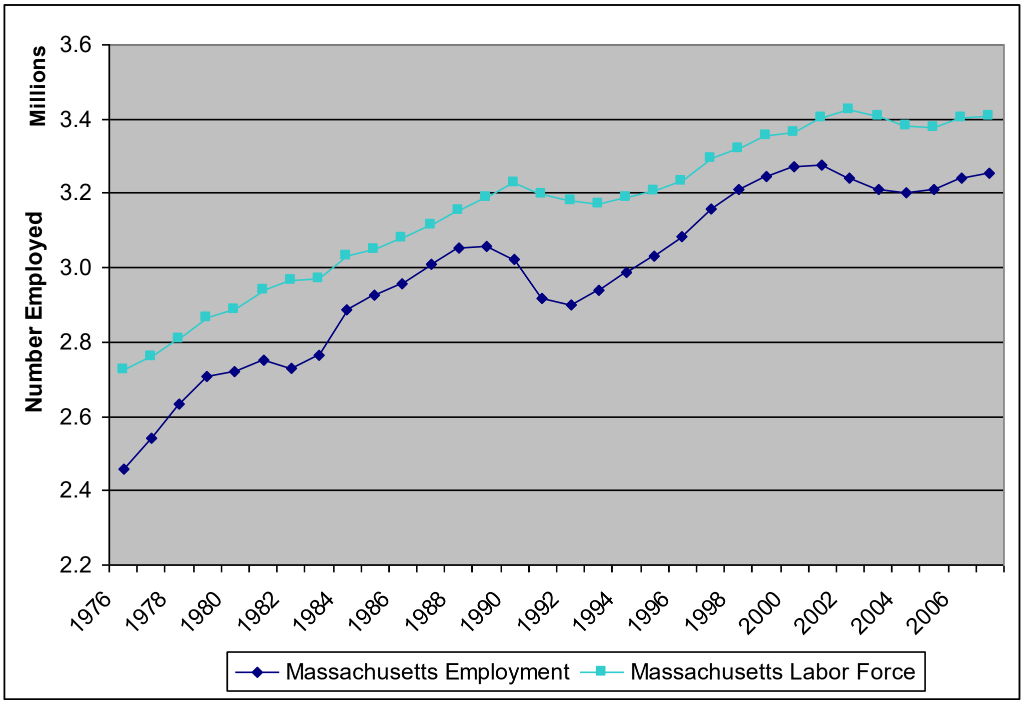
Figure 6: Indexed Employment Growth for Massachusetts and the US, 1990-2007



Source: US Bureau of Labor Statistics accessed July 3, 2008. Calculations by HDR
Note: Non-zero Y-axis.

As shown in Figure 7, the long-term Massachusetts employment and labor force trend is upward and periods when the gap (i.e., difference between labor force and employment) is greater are indicative of economic recession. This was most pronounced in the early 1990s with the strong recovery in the latter part of that decade and very low unemployment from 1998 to 2000.

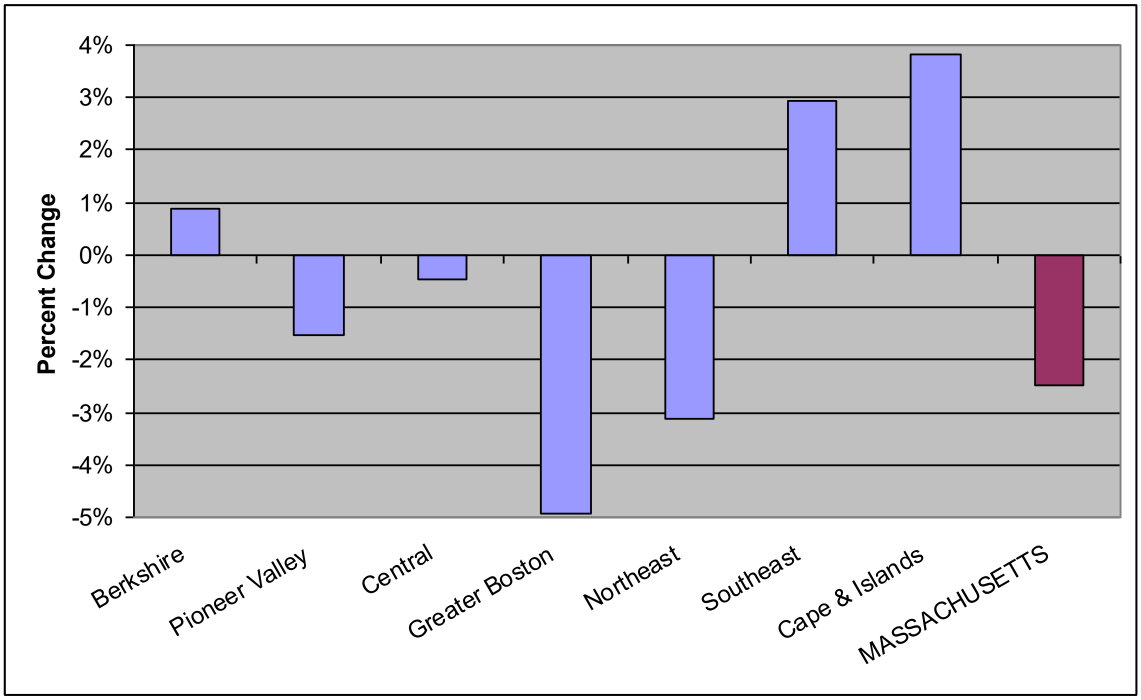
Figure 7: Average Annual Employment and Annual Labor Force Size, 1976-2007



Source: Massachusetts Executive Office of Labor and Workforce Development, revised April 2008
Note: Non-zero Y-axis.

On a regional basis, the greater Boston region was hit the hardest and recovered slowly from the recession in the early 2000s due to the region's heavy concentration in technology and information industries and the ~~"d~~ot com bubble." As shown in Figure 8, job growth from 2001 to 2007 was actually negative statewide as job levels still have not reached levels seen in 2001. Only the southeast, Cape and Islands, and Berkshire regions demonstrated positive job growth over this period.

Figure 8: Change in Total Employment by Region, 2001-2007



Source: US Bureau of Labor Statistics, accessed June 2008

3.1.3.2 Industry Sector Employment

While total non-farm employment saw modest growth in Massachusetts from 1997 to 2007 as shown in Table 2, this masks some more dramatic trends by industry. In general, Massachusetts epitomized a national trend away from manufacturing towards a service economy.

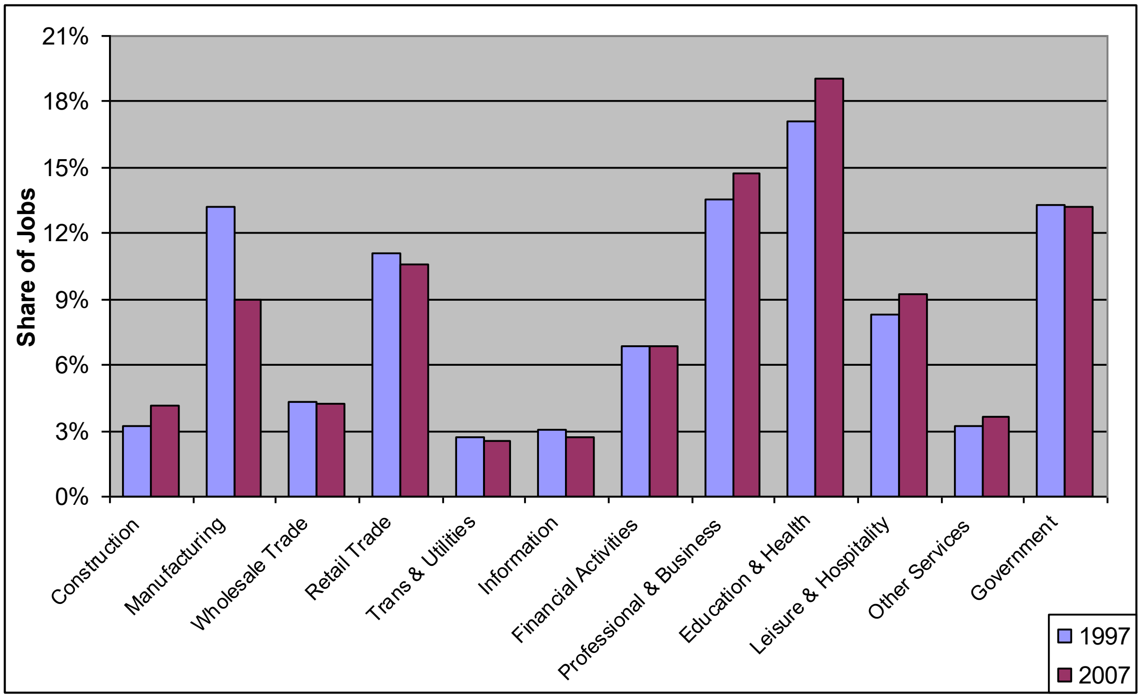
Table 2: Industry Breakdown of Jobs in Massachusetts, 1997 and 2007

	1997	2007
Total Nonfarm	3,113,900	3,277,200
Natural Resources and Mining	1,400	1,600
Construction	100,700	137,300
Manufacturing	412,400	295,300
Wholesale Trade	134,200	138,200
Retail Trade	345,100	348,100
Transportation and Utilities	85,200	84,400
Information	95,200	88,400
Financial Services	213,000	224,900
Professional and Business Services	421,400	481,500
Education and Health Services	532,900	623,500
Leisure and Hospitality	257,500	301,800
Other Services	100,100	119,700
Government	414,200	432,600

Source: US Bureau of Labor Statistics, accessed July 3, 2008

The leading growth sectors have been education and health care services; professional and business services; leisure and hospitality; with construction, wholesale trade, finance, and government also posting job gains. Education and health services now employ more people in Massachusetts than any other industry, accounting for 19 percent of all jobs in the Commonwealth, followed by professional and business services with 14.7 percent in 2007 (see Figure 9). Manufacturing and retail each accounted for nine percent of all jobs in 2007.

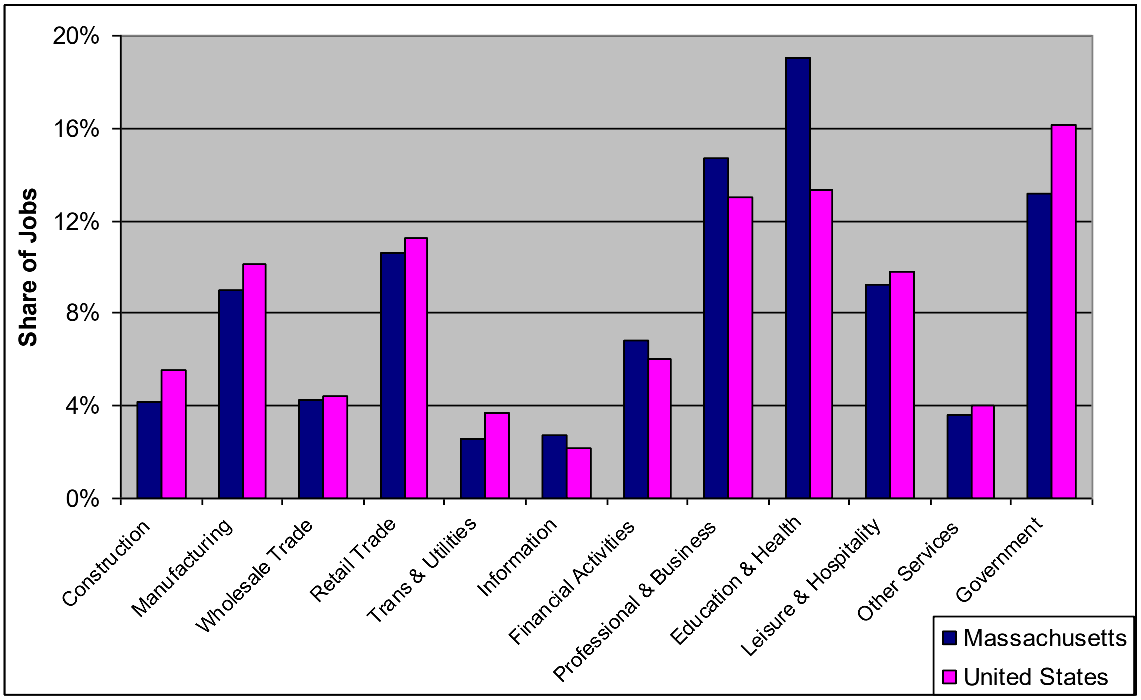
Figure 9: Comparison of Industry Share of Massachusetts Jobs, 1997 and 2007



Source: US Bureau of Labor Statistics, accessed July 3, 2008

The industrial mix in Massachusetts versus the US is presented in Figure 10. While the overall industry shares have a similar pattern, there are a number of notable exceptions. In particular, the education and health services sector and professional and business services sector are both much more heavily concentrated in Massachusetts than the nation. Financial services and information industries also are relatively concentrated. On the other hand, Massachusetts has a smaller share of government positions, as well as a smaller share of jobs in transportation, construction, and manufacturing (among others).

Figure 10: Industry Sector Employment for Massachusetts and the US, 2007



Source: US Bureau of Labor Statistics, Benchmark 2007, accessed July 3, 2008

Location quotients measure the relative concentration of an industry in an area compared to the country as a whole. If the location quotient is above one, the industry is more concentrated in the region than in the nation as a whole (and vice versa). The greater the number is, the more concentrated the industry. Table 3 shows how the industry concentrations vary by region within Massachusetts, where a shaded cell represents a relative industry concentration (location quotient greater than one). Education and health services consistently have a higher location quotient in all regions of the Commonwealth. It is interesting to note that while Massachusetts is relatively small in geographic terms, industry strengths can vary significantly by region. For example, the Pioneer Valley, central Massachusetts, southeast and northeast regions of the Commonwealth all show relatively high concentrations in manufacturing sectors. While the southeast and the Cape and Islands have a greater concentration in trade and transport. In greater Boston, the concentrations are all in service sectors, while other regions are more varied in terms of industry mix.

Table 3: 2007 Industry Location Quotients by Region for Massachusetts

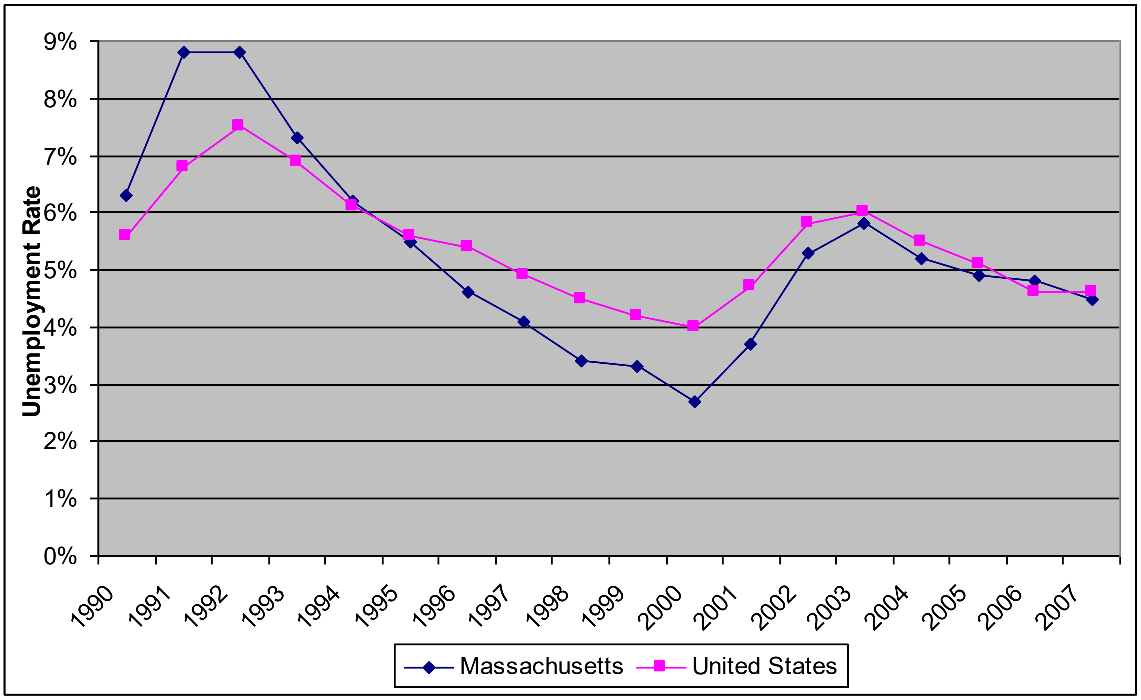
		Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape & Islands	MA
Goods	Natural Resources	0.76	0.76	0.45	0.25	0.42	1.14	0.66	0.45
	Construction	0.86	0.67	0.76	0.65	0.75	0.93	1.22	0.74
	Manufacturing	0.87	1.13	1.26	0.67	1.46	1.08	0.22	0.87
Service Producing	Trade & Transport	0.87	0.96	0.97	0.74	0.88	1.18	1.10	0.87
	Information	0.69	0.77	0.69	1.53	0.86	0.65	0.86	1.18
	Financial Activities	0.72	0.85	0.82	1.42	0.71	0.64	0.70	1.11
	Professional & Business	0.64	0.59	0.84	1.36	0.90	0.68	0.69	1.10
	Education & Health	1.57	1.55	1.37	1.35	1.25	1.17	1.17	1.32
	Leisure & Hospitality	1.38	0.96	0.90	0.82	0.95	1.05	1.89	0.92
	Other Services	1.16	1.36	1.87	0.83	0.98	1.12	1.06	0.94

Source: Massachusetts Executive Office of Labor and Workforce Development and US Bureau of Labor Statistics

3.1.3.3 Unemployment

Since about 1995, the unemployment rate in Massachusetts has been below or at the national average. Most recently, the Commonwealth's unemployment rate has been very similar to that of the nation, as seen in Figure 11. However, the diverse regions across Massachusetts react differently to economic conditions as seen in Table 4, where the unemployment rate varies by county. In 2007, unemployment was lowest in Dukes (Gosnold and Martha's Vineyard) and Middlesex (greater Boston) counties, and highest in Bristol (southeast) and Hampden (Springfield area) counties. It is worth noting that unemployment is based on place of residence rather than place of work such that, for example, the low unemployment rate in Middlesex partly reflects commuters from the suburbs commuting to jobs in Boston. Currently, in Massachusetts unemployment is now being reduced at a faster rate than nationally.

Figure 11: Average Annual Unemployment Rates for Massachusetts and the US, 1990-2007



Source: Massachusetts Executive Office of Labor and Workforce Development, revised April 2008

Table 4: Average Annual Unemployment Rate by County in Massachusetts, 2007

County	Unemployment Rate
Berkshire	4.4%
Franklin	4.3%
Hampden	5.6%
Hampshire	3.8%
Worcester	4.9%
Middlesex	3.6%
Suffolk	4.5%
Norfolk	3.9%
Essex	4.7%
Bristol	5.8%
Plymouth	4.7%
Barnstable	4.8%
Dukes	3.5%
Massachusetts	**4.5%**

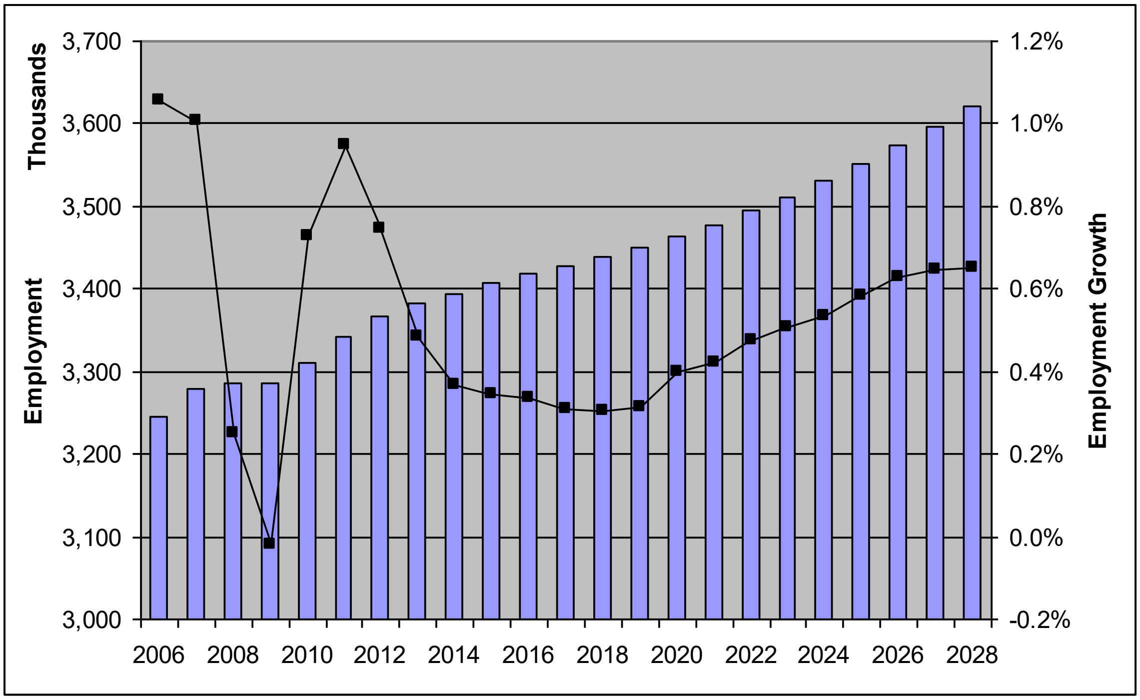
Source: Massachusetts Executive Office of Labor and Workforce Development

3.1.3.4 Total Employment Forecast

The overall modest employment growth trends in Massachusetts are expected to continue between 2008 and 2028, growing 10.2 percent for the entire period, or 0.5 percent annually (Figure 12). This would bring the number of jobs from nearly 3.3 million in 2008 to more than

3.6 million in 2028. Note that job and population trends move in tandem. In both cases, slow growth is projected for the Commonwealth.

Figure 12: Massachusetts Total Employment and Growth Trend Line, Historical for 2006 and 2007, Projected 2008-2028



Source: Global Insight TRANSEARCH Spring 2008 Release

3.1.3.5 Industry Employment Forecasts

Global Insight projections (Table 5) indicate that manufacturing employment will decline over the next 30 years, albeit at a much slower rate than over the past 10 years. Although employment in this sector is anticipated to decline, the share of manufacturing exports is expected to continue to grow which is consistent with productivity advancements. Additionally, the relative concentration and growth in professional and business services is expected to continue through the forecast period. Other sectors projected to grow over the next 20 years include: construction; transportation; warehousing and utilities; education and health services; leisure and hospitality; and other services.

Table 5: Massachusetts Employment by Industry in Thousands, Historical for 1998 and 2007, and Projected for 2008, 2018, and 2028

		Historical		Forecast			Growth Rates		
		1998	2007	2008	2018	2028	2007-2008	2008-2018	2018-2028
Goods	Natural Resources and Mining	1.4	1.58	1.66	1.73	1.79	5.1%	4.2%	3.5%
Goods	Construction	108.45	137.38	130.37	135.26	152.4	-5.1%	3.8%	12.7%
Goods	Manufacturing	412.95	295.51	288.97	273.68	262.22	-2.2%	-5.3%	-0.4%
Service Producing	Wholesale Trade	137.68	138.22	139.02	133.97	129.38	0.6%	-3.6%	-3.4%
Service Producing	Retail Trade	349.71	348.37	344.6	337.04	324.99	-1.1%	-2.2%	-3.6%
Service Producing	Transportation, Warehousing & Utilities	88.24	84.32	83.94	100.56	113.23	-0.5%	19.8%	12.6%
Service Producing	Information	97.79	88.43	89.98	86.3	95.78	1.8%	-4.1%	11.0%
Service Producing	Financial Activities	221.63	224.97	222.64	224.16	219.51	-1.0%	0.6%	-2.1%
Service Producing	Professional and Business Services	441.51	481.43	487.23	579.13	727.53	1.2%	18.9%	25.6%
Service Producing	Education and Health Services	536.42	623.63	637.46	680.13	694.53	2.2%	6.7%	2.1%
Service Producing	Leisure and Hospitality	262.83	301.60	305.35	320.77	326.12	1.2%	5.0%	1.7%
Service Producing	Other Services	103.38	119.62	119.17	121.24	130.77	-0.4%	1.7%	7.9%
Service Producing	Government	421.88	433.06	435.94	444.75	441.88	0.7%	2.0%	-0.6%
	Total Nonfarm	**3,183.88**	**3,278.10**	**3,286.35**	**3,438.72**	**3,620.13**	**0.3%**	**4.6%**	**5.3%**

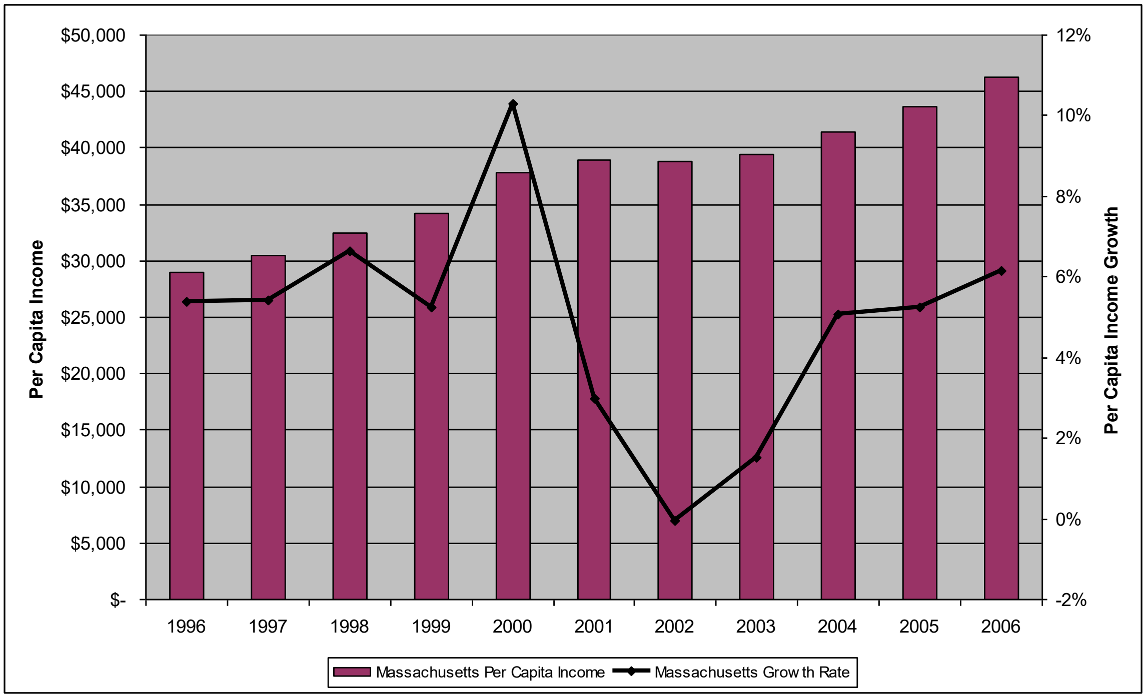
Source: Global Insight TRANSEARCH Spring 2008 Release

3.1.4 PER CAPITA INCOME AND WAGES

Consistent with the strong industrial base and skilled workforce, the income and earning potential of Massachusetts residents has been one of the greatest economic strengths of the Commonwealth. As shown in Figure 13, per capita income has been steadily growing at a rate of about five percent per year, other than dips from 2001 to 2003 where it still grew but more slowly. In 2006, the statewide per capita income was $46,299, which is 126 percent of the $36,714 US per capita income. Over the past ten years, Massachusetts per capita income has consistently been greater than the United States, with the gap widening after 2000 (Figure 14). For example, in 2006, Massachusetts total personal income was $297.9 billion, representing 2.7 percent of the nation's income, while the Commonwealth's population was 2.1 percent of the US total.

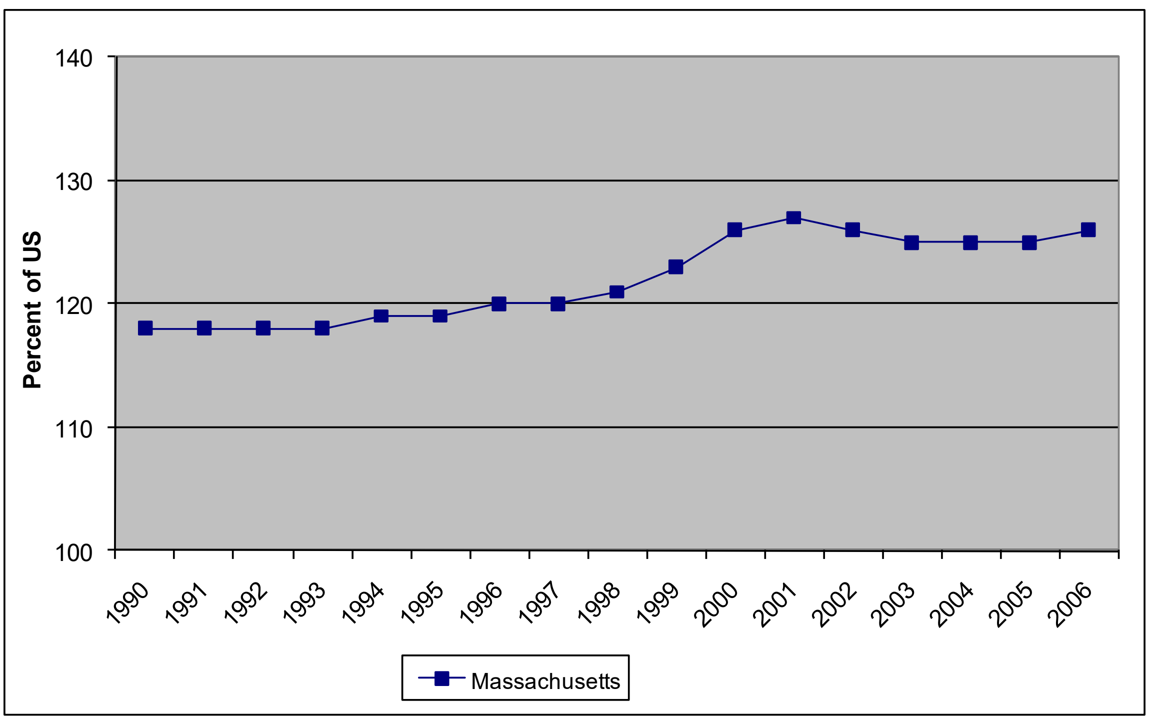
There are multiple reasons for this high per capita income, such as high educational achievement levels and an industry mix tilted towards higher paying jobs. The implication of this is significant purchasing power and a high demand for goods and services, many of which need to be transported into Massachusetts via the freight system.

Figure 13: Per Capita Income in Massachusetts and Growth Rate of Per Capita Income, 1996-2006



Source: Bureau of Economic Analysis, last updated May 2008

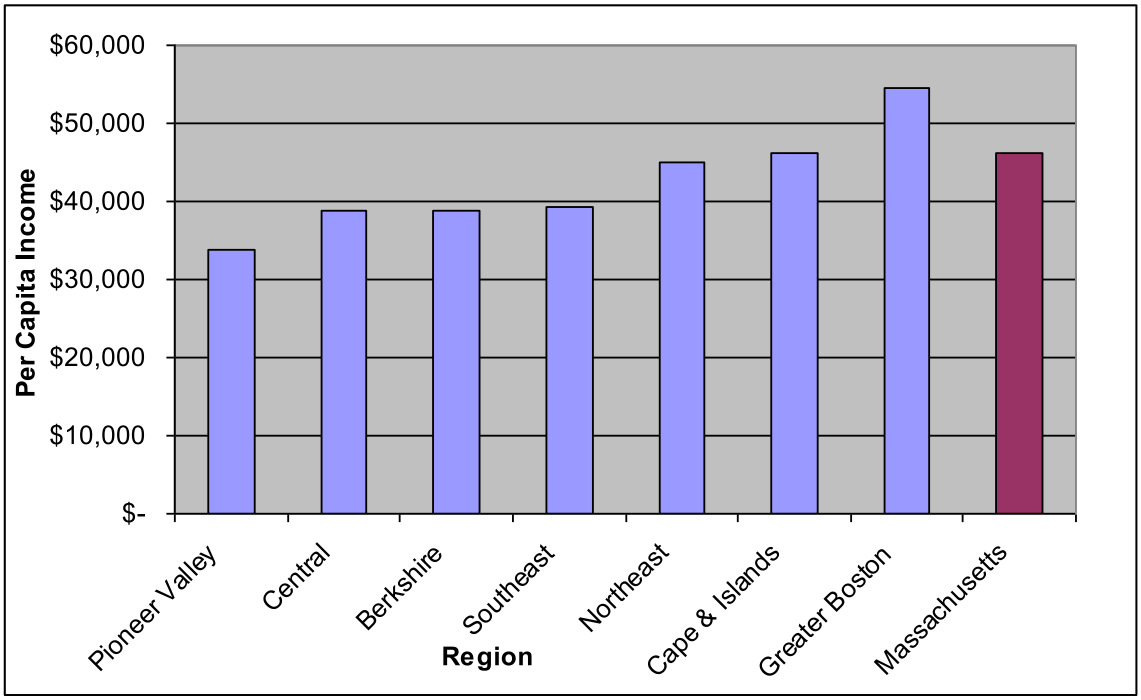
Figure 14: Massachusetts Per Capita Income as a Percent of US Per Capita Income



Source: Bureau of Economic Analysis, last updated May 2008
Note: Non-zero Y-axis.

Per capita income for 2006 is presented in Figure 15 and varies by region in Massachusetts. It was highest in greater Boston at well over $50,000 per person. The Pioneer Valley region is the only sub-state region with per capita income below the US average with most other regions just below or above $40,000 per person.

Figure 15: Per Capita Income by Region, 2006



Source: Bureau of Economic Analysis, last updated May 2008

The professional mix in Massachusetts contributes to the high level of income within the Commonwealth. As Table 6 shows, some of the most concentrated industries in Massachusetts (i.e., information, financial activities, and professional and business services) also pay the highest average wages per job. Paying $885 per week on average, the health and education sectors do not pay above average weekly wages in Massachusetts. When compared to the national average, however, they do pay more than the US average of $818 across all industries. Additionally, they pay approximately $130 more per week than this sector at the national level, reflecting the concentration of internationally recognized, higher-paying educational and health care positions throughout Massachusetts.

Table 6: Average Weekly Wages by Industry for Massachusetts, 2002, 2004, 2006

	2002	2004	2006
Natural Resources & Mining	$ 696	$ 794	$ 868
Construction	$ 989	$ 990	$ 1,056
Manufacturing	$ 1,062	$ 1,171	$ 1,256
Trade & Transportation	$ 709	$ 764	$ 804
Information	$ 1,232	$ 1,341	$ 1,491
Financial Activities	$ 1,486	$ 1,760	$ 1,814
Professional & Business	$ 1,097	$ 1,199	$ 1,335
Education & Health	$ 747	$ 824	$ 885
Leisure & Hospitality	$ 351	$ 372	$ 390
Other Services	$ 483	$ 499	$ 515
Public Administration	$ 899	$ 981	$ 1,038
Total, All Industries	**$ 865**	**$ 941**	**$ 1,008**

Source: Massachusetts Executive Office of Labor and Workforce Development

3.1.4.1 Consumer Demand and Retail Sales

The Commonwealth's high per capita income and wages attribute to a large consumer demand market. Retail and eating and drinking establishments are estimated to generate $81.8 billion in sales in Massachusetts 2008 (Table 7). Retail spending accounted for $68.8 billion in sales with revenue for restaurants (food and drinking places) at approximately $13 billion. In terms of total sales, food and beverage stores, motor vehicle and parts, and food services and drinking places dealers account for half of the total consumer spending in Massachusetts.

Table 7: Total Retail Sales ($Billions), 2008

Retail Sector	Total Sales	Percent
Food & Beverage Stores	$ 17.3	21%
Motor Vehicle & Parts Dealers	$ 17.2	21%
Food Services & Drinking Places	$ 13.0	16%
Gasoline Stations	$ 5.8	7%
Clothing and Clothing Accessories Stores	$ 5.2	6%
General Merchandise Stores	$ 4.9	6%
Health & Personal Care Stores	$ 4.1	5%
Bldg Materials, Garden Equip. & Supply Stores	$ 3.5	4%
Furniture & Home Furnishings Stores	$ 2.9	4%
Non-store Retailers	$ 2.6	3%
Electronics & Appliance Stores	$ 2.6	3%
Sporting Goods, Hobby, Book, and Music Stores	$ 1.4	2%
Miscellaneous Store Retailers	$ 1.3	2%
Total	**$ 81.8**	

Source: 2008 ESRI Retail Market Place Profile, TREDIS

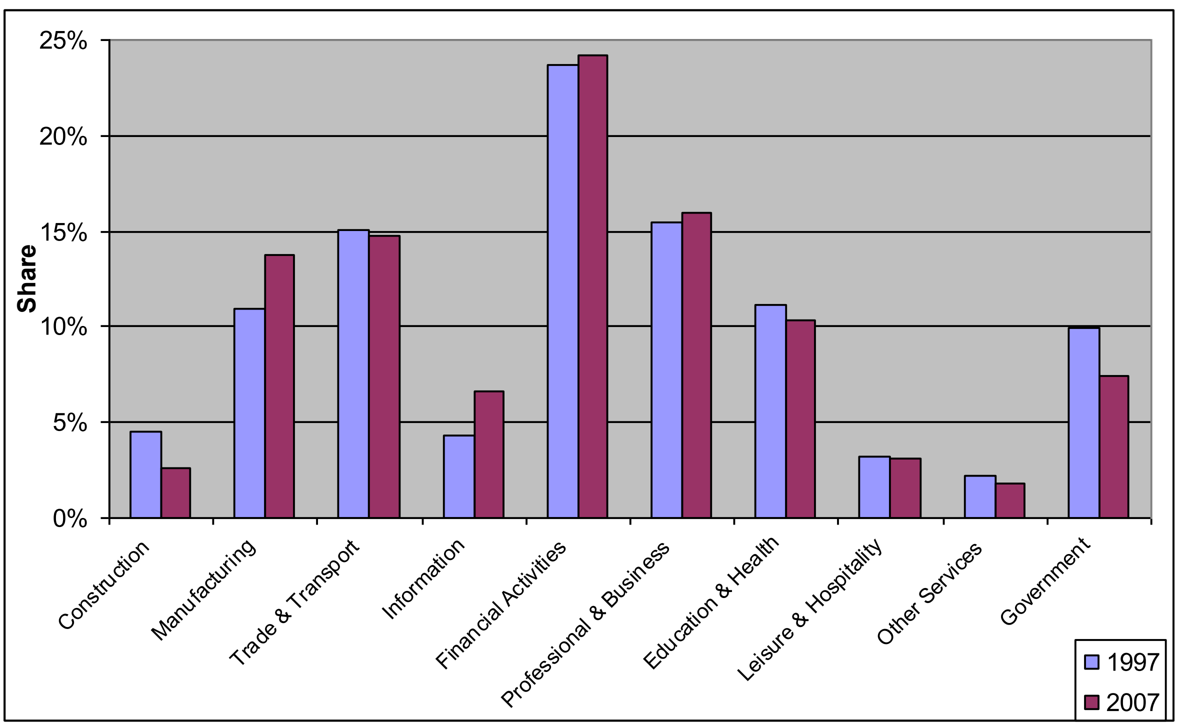
3.1.5 GROSS STATE PRODUCT AND TRADE

Gross State Product (GSP) is a common measurement of economic performance and is analogous to Gross Domestic Product (GDP) at the US level as an indicator of total economic production (value-added). In 2007, the GSP of Massachusetts was $305.4 billion dollars, which is 2.5 percent of the total GDP of the United States. From 1997 to 2007, real GSP in Massachusetts increased by 34.5 percent, 1.5 percentage points faster than the US. Given the fact that both jobs and people grew at a much more modest pace in the Commonwealth than nationally over this same period, this growth in GSP is a testament to the productivity of the Massachusetts workforce and the high-value nature of the industry mix.

Despite that, jobs in manufacturing are generally in decline, the productivity of the industry in terms of GSP actually increased throughout the Commonwealth, as seen in Figure 16. Manufacturing's share of GSP not only kept pace with other Massachusetts sectors but increased its share of total economic activity. This trend is also on display in Figure 17, which shows 1997-2007 growth in GSP by industry for both Massachusetts and the US. As freight transportation needs are more tied to production, it is critical to closely watch these trends as simply examining manufacturing employment would understate the freight transportation needs of manufacturing. Much of the manufacturing GSP growth is from high value-added industries like medical devices and electronics.

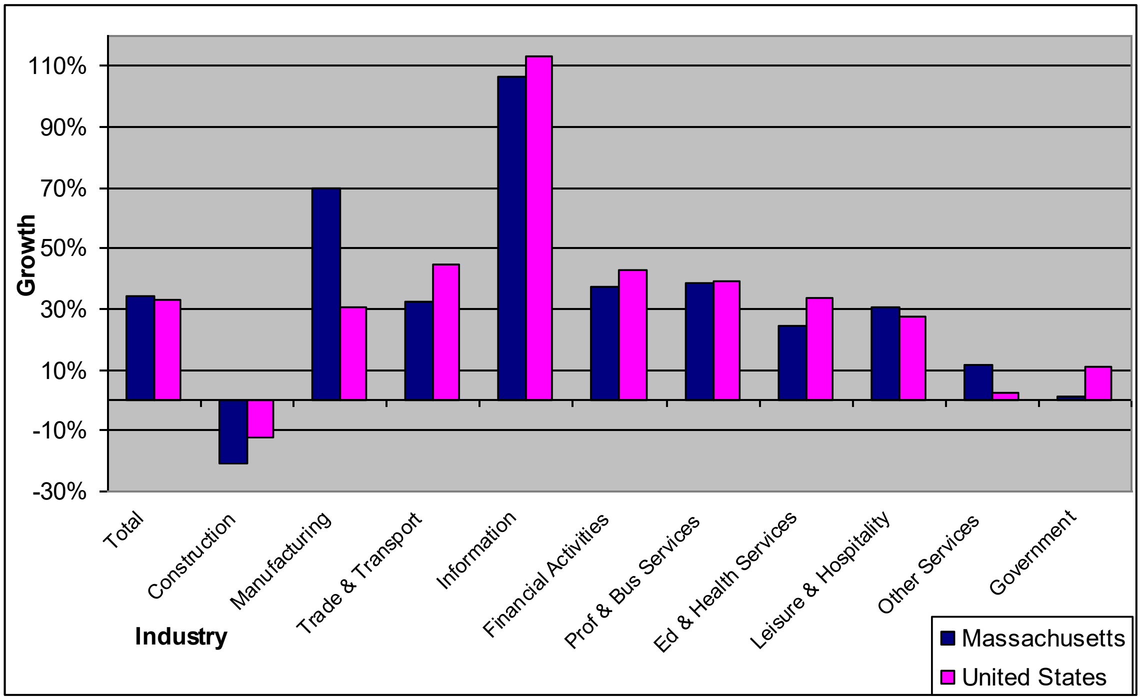
Of note, while Massachusetts maintains a strong competitive advantage in higher education and health care services and hospitals, this industry did not grow as quickly as the national average over this time period as the education and health care industry grew by over 30 percent at the US level. These figures are all in real (constant) 2000 dollars that adjust for inflation.

Figure 16: Share of Gross State Product Produced by Industry in Massachusetts, 1997 and 2007



Source: Bureau of Economic Analysis, last updated May 2008

Figure 17: Growth in Gross State Product by Industry for Massachusetts and the US, 1997-2007



Source: Bureau of Economic Analysis, last updated May 2008

In 2007, Massachusetts exported $25.3 billion dollars worth of goods. Seven commodities had export values above one billion dollars:[4]

- Optics, medical and surgical instruments;
- Electric machinery, sound equipment, and television equipment;
- Industrial machinery, including computers;
- Pharmaceutical products;
- Pearls, precious stones, precious metals, and coins;
- Plastics and related plastics products; and
- Organic chemicals.

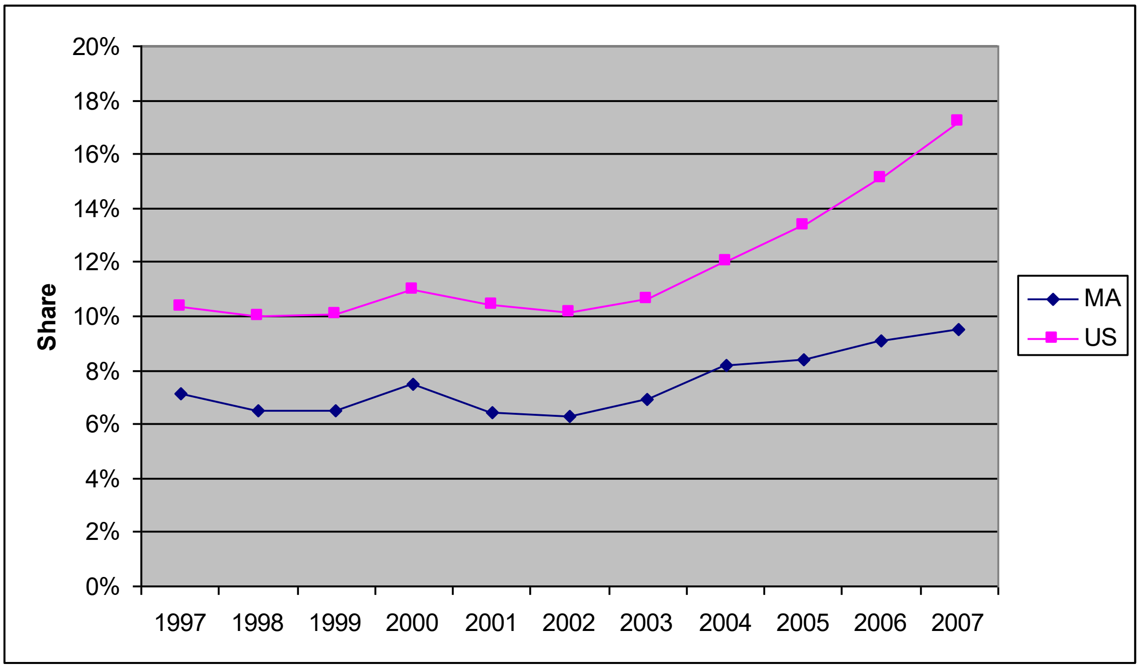
The large presence of health and life sciences centers in the Commonwealth has led to heavy production of both medical and surgical equipment and pharmaceutical products. The pharmaceutical product industry has been quickly expanding as a presence in the Commonwealth over the last ten years, increasing exports from less than $300 million dollars in 1997 to more than $2.5 billion in 2007.

After these top seven commodities, seafood is the next most valuable export of Massachusetts. In 2007, more than $412 million dollars worth of fish, crustaceans, and aquatic invertebrates were shipped out of the Commonwealth. The amount of seafood exports reiterates the historical and current value of the fishing and processing industries to the Commonwealth's economy.

[4] 2007 WISERTrade Data – see http://www.wisertrade.org/home/index.jsp

Total international exports from Massachusetts firms as a percentage of GSP from 1997 to 2007 are shown in Figure 18. Compared to the US average, exports in Massachusetts are generally growing in importance to the overall economy, however, comparatively are consistently smaller as a share of total economic activity. Furthermore, exports have not grown as rapidly in recent years. Again, this reflects an industry mix more concentrated in the service sector with a relatively smaller manufacturing sector, as well as the relatively modest agriculture, lumber/logging, and mining industries compared to other parts of the US.

Figure 18: Exports as a Share of GDP (US) and GSP (MA), 1997-2007

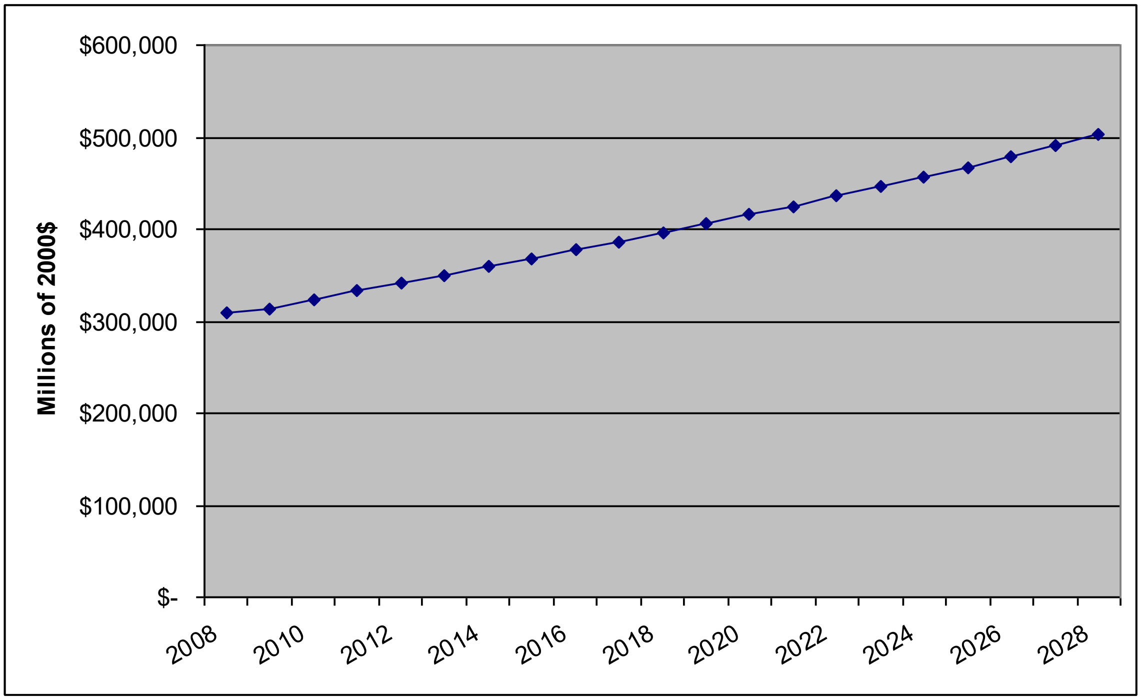


Source: WISERTrade and US Bureau of Economic Analysis

3.1.5.1 Forecast of Gross State Product

Gross State Product in Massachusetts is projected to grow from about $305 billion dollars in 2007 to $503 billion dollars in 2028 (Figure 19). The projected growth of GSP is significantly larger than the projected growth in employment over the same period, indicating an increase in labor productivity, as well as the need to track industry activity in terms of production to more accurately reflect the transportation needs of the Commonwealth's industries.

Figure 19: Forecast Gross State Product for Massachusetts through 2028



Source: Global Insight TRANSEARCH Spring 2008 Release

3.1.6 THE ROLE AND IMPORTANCE OF FREIGHT IN THE MASSACHUSETTS ECONOMY

This section describes: a) the importance of the transportation and logistics sector in the Commonwealth and sub-state regional economies; b) industries that are dependent on freight movement; c) the modes that these industries rely on to ship and receive freight; and d) key inbound and outbound markets. By examining the movement of freight in these ways, it is possible to show how important freight is to the Commonwealth's economy and how transportation serves various industries both statewide and regionally.[5]

Cost-effective and efficient freight service is an essential component for industrial competitiveness in the Commonwealth, and it is vital to the economic well-being of the Commonwealth's citizenry. Inbound goods to Massachusetts are either consumed locally or used as intermediate inputs for industries to add value for further production. Outbound goods result from industrial production to satisfy industry and household demand outside the Commonwealth. In addition, goods moving through Massachusetts make use of in-state logistics and transportation industries for expediting movement.

Three core data sources are used in this analysis. Statewide trade data was primarily derived from the FHWA's Freight Analysis Framework (FAF[2]). Trade data for Massachusetts regions used the TRANSEARCH database from Global Insight. Both data sources provide commodities, modes, origins, and destinations from freight movements in North America. Data describing the Commonwealth and regional economies, such as jobs by industry, comes from

[5] The focus of this analysis is on goods moved in and out of Massachusetts – both domestically and internationally. For purposes of this study, an ―outbound shipment" is a commodity sent from an area in Massachusetts to another state or country. An ―inbound shipment" is a good that is delivered to a given area in Massachusetts from external regions. Both terms are used interchangeably for domestic or international points of origin and destination.

an IMPLAN model for Massachusetts, which packages information from US Department of Commerce, US Economic Census, and County Business Patterns.

3.1.6.1 Transportation in the Commonwealth Economy

The transportation sector is a vital part of the Massachusetts economy for both businesses that rely on it for deliveries of raw materials and shipment of final goods, as well as consumers who rely on the sector for the delivery of services and goods. The transportation sector is also diverse due to the Commonwealth's geographical location, making use of all possible modes, including air, rail, water, and road. As Table 8 shows, the transportation sector directly employs over 121,000 people in the Commonwealth (three percent of total employment), which is lower in percentage terms when compared to transportation sector employment for the US.

In terms of output, the Commonwealth produces $13.7 billion in transportation services (2.3 percent of the Commonwealth's output). This is relatively low compared to the nation (3.1 percent of total), partially due to Massachusetts being primarily a service-based economy. The Commonwealth has a lower percentage of employment in both agriculture/mining and manufacturing compared to the nation. These types of goods and bulk commodity-producing industries are generally more heavily reliant on freight transportation than service industries, which tend to rely more on parcel and small package delivery services.

Table 8: Transportation and Logistics Employment and Output (MA and US), 2006

	MA	US
Total Employment	4,062,417	174,722,999
Transportation Employment	121,958	6,628,850
% of Total Employment	3.0%	3.8%
Total Output ($mil)	607,657.29	24,774,467.09
Transportation Output ($mil)	13,694.24	776,039.29
% of Total Output	2.3%	3.1%
Output/Transportation Worker	$112,286	$117,070

Source: US Department of Commerce from IMPLAN

The contributions of industries within the transportation sector for the Massachusetts economy are shown in Table 9. Freight and rail industries contribute approximately 34,600 jobs and $5 billion in output.[6] Postal service and transit generate the most transportation-oriented jobs in the Commonwealth, 26,450 and 24,561 jobs, respectively. However, the output per worker (i.e., labor productivity) is larger for capital-intensive industries like pipeline and water transportation. Rail, air, and truck transportation are less capital-intensive and handle a more diverse set of goods as well as passengers (for rail and air transportation). More labor-intensive industries such as couriers, warehousing and storage, postal service, and transit and ground transportation have lower labor productivity.

The largest employers in transportation, in decreasing order, include postal service, transit and ground transportation, and truck transportation. In terms of industry concentration, only postal service, and transit and ground transportation are higher in Massachusetts than in the US. High postal service employment is due to the large business and consumer markets within the

[6] These industries are defined as rail transportation, water transportation, truck transportation, and warehousing and storage. Air transportation was not included as it is mostly passenger related.

Commonwealth, and the role of the Boston metropolitan area as a hub of the postal service's New England operations. The transit industry has a large concentration due to the MBTA, Amtrak, private bus operators, and other regional public transit systems in the Commonwealth. The industries that have grown most rapidly in recent years include postal service, rail transportation, and truck transportation indicating increased demand for freight movement. Passenger-dependent forms of transportation, such as air transportation and transit and ground transportation, have recently seen a decline in employment.

Table 9: Labor Productivity in Transportation and Logistics Industries, 2006

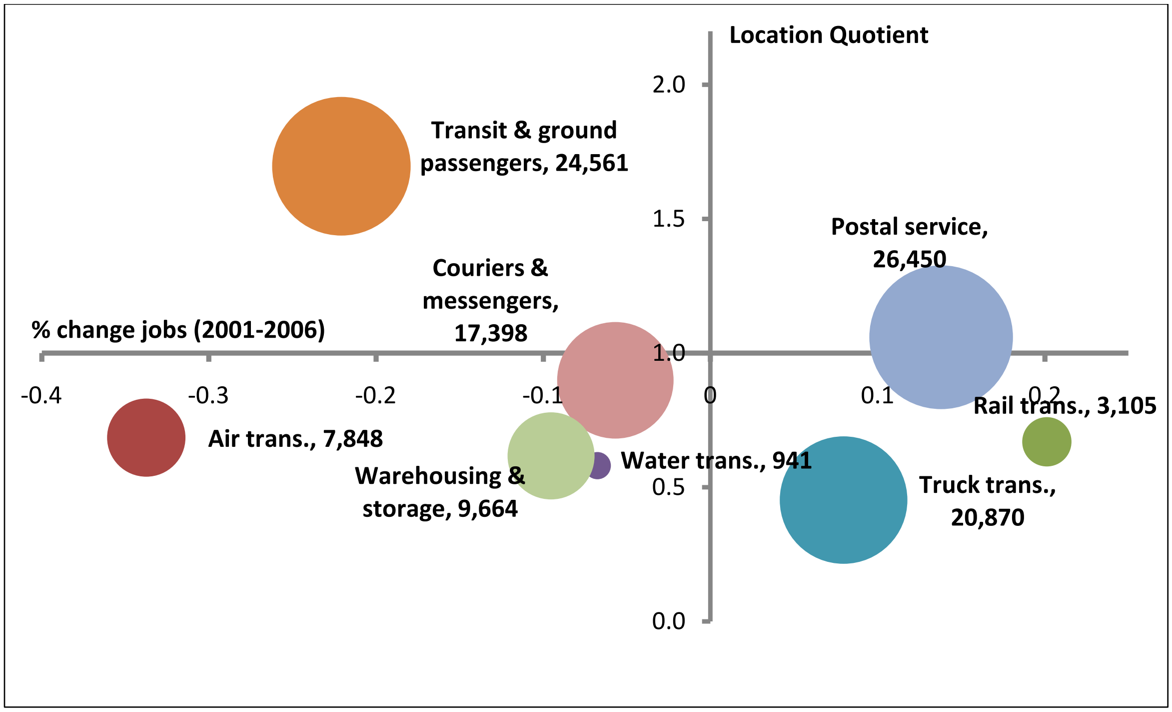
MA jobs	Output ($mil)	Employment	Output/Worker ($)
Air Transportation	1,739	7,848	221,538
Rail Transportation	819	3,105	263,873
Water Transportation	481	941	510,950
Truck Transportation	2,927	20,870	140,267
Transit & Ground Passengers	1,414	24,561	57,578
Pipeline Transportation	1,667	3,100	537,735
Sightseeing Transportation	691	8,021	86,124
Postal Service	1,901	26,450	71,870
Couriers & Messengers	1,272	17,398	73,084
Warehousing & Storage	784	9,664	81,093
Total	**13,694**	**121,958**	**112,286**

Source: US Department of Commerce from IMPLAN

The recent trends, relative concentrations, and sizes of each transportation and logistics industry in terms of employment are shown in Figure 20. The horizontal axis shows the change in total employment by sector between 2001 and 2006. The vertical axis shows the relative concentration of employment in each sector compared to the overall US employment in that sector. Industries with the same relative concentration of employment as the US would have a Location Quotient (LQ) of one.[7] Those with less concentrated employment in a sector than the US would have an LQ below one, and those with a higher concentration of employment would have an LQ greater than one. The size of each circle shows the total employment in each sector as of 2006, and the circles are labeled to show both the name of the sector and the 2006 employment. For example, the truck transportation sector has 20,870 employees in Massachusetts, which results in a relatively small LQ of about 0.45 but the industry has been growing nationally in recent years (2001 to 2006) at just under 10 percent. The warehousing and storage industry provided almost 10,000 jobs with an LQ of about 0.6 with a national growth trend of about negative 10 percent, meaning a drop in jobs over that time period.

[7] Location quotients show the relative local concentration of an industry compared to a reference economy. In this report, the local economy is the Commonwealth of Massachusetts and the reference economy is the US. Thus, LQs show the ratio of the percent of employment in Massachusetts divided by the percent of employment in the same industry for the US.

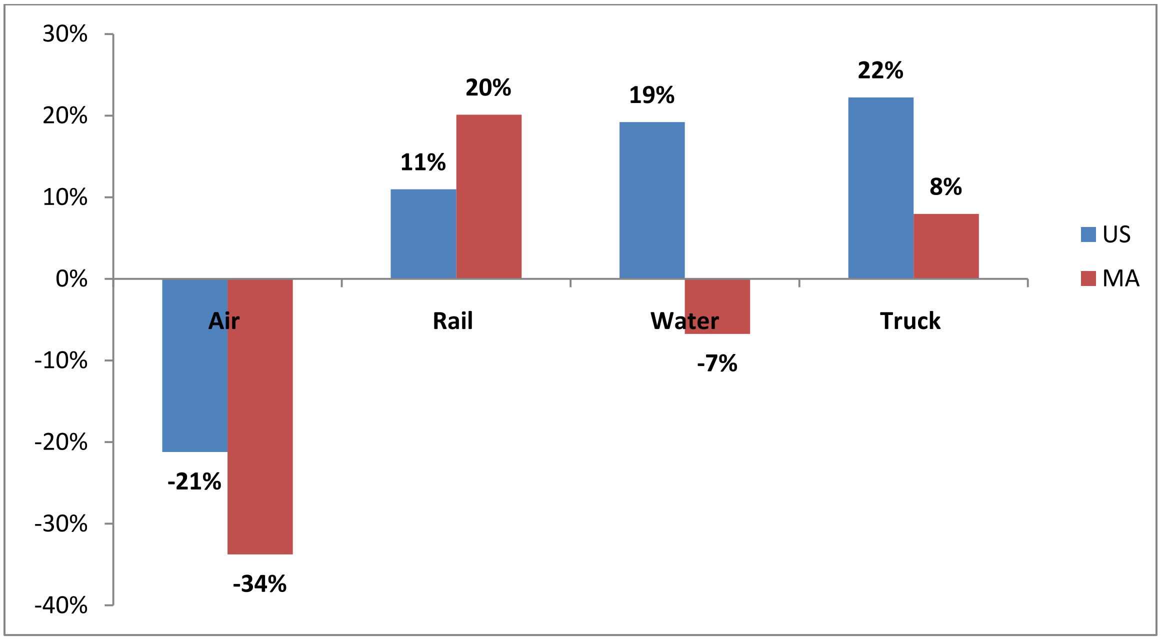
Figure 20: Employment, Industry Concentration (LQ), and Recent Trends (Percent Change) for Transportation and Logistics Industries, 2006



Source: US Department of Commerce from IMPLAN

The recent trends in employment by mode of transportation for Massachusetts compared to the US are shown in Figure 21. These four industries are singled out since they are directly responsible for the movement of freight. However, air, rail and water transportation also involve the movement of passengers; therefore, these industries are also affected by demand for personal and business travel. The Commonwealth has a lower employment growth rate relative to the nation in every mode with the exception of rail transportation. This is likely due to two factors: a) the overall Massachusetts employment growth rate over this period lagged the US average growth; and b) the Massachusetts economy continues to evolve to focus less on industrial, heavy freight industries and more on high-skill, innovative industries.

Figure 21: Employment Trends of Massachusetts Compared to US (Percent Change), 2001-2006



Source: US Department of Commerce from IMPLAN

3.1.6.2 Transportation in Regional Economies

The sub-state location patterns of transportation and logistics jobs in Massachusetts are indicative of the kinds of economic activity being supported in the regions. Table 10 shows the distribution by region in Massachusetts in terms of employment and percentage of the Commonwealth total, respectively. Not surprisingly, a majority of Massachusetts transportation employment is located in the greater Boston region since this is a major hub of air, rail, water, and road transportation. Air and rail transportation have especially high concentrations of employment due to the presence of Logan International Airport and intermodal facilities in Boston, respectively. There are also small pockets of rail employment in central Massachusetts and the Pioneer Valley, since these areas lie on major east-west and north-south corridors.

Employment related to trucking and warehousing is more evenly distributed among the regions. These components of freight movement are typically required at the beginning and/or end of freight movement and tend to exist where businesses and consumers are concentrated.

Table 10: Transportation and Logistics Employment by Region

	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands
Air Transportation	20	76	51	6,989	170	34	389
Rail Transportation	51	240	298	2,323	62	111	19
Water Transportation	1	105	3	490	23	58	244
Truck Transportation	386	3,225	3,213	9,038	1,468	3,110	310
Transit & Ground Passengers	454	2,629	3,018	13,161	1,547	3,135	450
Pipeline Transportation	0	754	202	2,138	7	0	0
Sightseeing Transportation	90	513	472	5,278	623	757	241
Postal Service	334	4,582	2,104	12,533	1,395	4,838	599
Couriers & Messengers	92	1,509	2,050	9,616	1,370	2,131	541
Warehousing & Storage	215	887	1,209	3,541	479	3,210	121
Total	**1,643**	**14,520**	**12,620**	**65,107**	**7,144**	**17,384**	**2,914**

Source: US Department of Commerce from IMPLAN

Table 11 shows the location quotients for regional employment in transportation and logistics industries. These are estimated using the relative percentage employment in each region compared to the nation (high concentrations are in bold). All regions have a higher concentration in transit and ground passenger transportation (due to the MBTA and local transit authorities) while other concentrations vary across regions. The Cape and Islands have a high concentration in air and water transportation due to their relatively high dependence on many small airports and passenger ferries, respectively.

Table 11: Industry Concentration (Location Quotient)

	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands
Air Transportation	0.09	0.08	0.05	1.11	0.16	0.02	1.10
Rail Transportation	0.55	0.61	0.67	0.92	0.14	0.19	0.13
Water Transportation	0.04	0.77	0.02	0.55	0.16	0.29	4.89
Truck Transportation	0.42	0.83	0.72	0.36	0.34	0.55	0.22
Transit & Ground Passengers	1.57	2.14	2.16	1.66	1.16	1.76	1.01
Pipeline Transportation	0.00	9.98	2.34	4.38	0.08	0.00	0.00
Sightseeing Transportation	0.30	0.41	0.33	0.65	0.45	0.41	0.52
Postal Service	0.67	2.17	0.87	0.92	0.60	1.58	0.78
Couriers & Messengers	0.24	0.92	1.10	0.91	0.77	0.90	0.91
Warehousing & Storage	0.69	0.67	0.80	0.41	0.33	1.67	0.25

Source: US Department of Commerce from IMPLAN

3.1.6.3 Massachusetts Freight Transportation Use and Trade Patterns

The transportation and logistics industries discussed above provide both direct goods movement and support for key industries in Massachusetts. However, they also involve services for households and passengers. Identifying the types of commodities that are being handled serves to highlight freight-related transportation activities. This analysis also links transportation and logistics activities with industries in the Commonwealth that are dependent on them.

3.1.6.4 Modal Dependency of MA Industries

The types of goods being shipped and the distances of the shipments heavily influence the mode of transportation for freight. The types of modes included in this analysis are: truck, rail, water, air, intermodal, and pipeline. Intermodal movements may include any combination of modes, a majority of which would involve the use of trucks.

Massachusetts primarily relies on trucking for direct movement of goods and indirectly through intermodal transfers. Truck transportation is especially critical for manufactured goods and natural resources that are time-sensitive for delivery. Focusing on inbound goods movement by value (Table 12), trucking and intermodal[8] freight shipments dominate the freight use by industry. Direct rail shipments are most often used by the wood products and paper industries. The rail modal dependencies by industry are a bit lower than the overall rail mode share presented elsewhere as rail activity is also included within the intermodal category. Air freight is a critical mode for computers and electronic products, chemicals and miscellaneous manufacturing.

Table 12: Domestic Inbound Shipments and International Imports (Percent Value by Mode)

	Truck	Rail	Air	Intermodal	Pipeline & Unknown
Crop Products	95%	2%	1%	2%	1%
Animal Products	95%	0%	5%	0.3%	0%
Forestry & Logging	99%	0%	0%	0%	1%
Stone and Gravel	98%	2%	0%	0%	0.1%
Food Products	95%	2%	0.1%	1%	2%
Beverage & Tobacco Products	90%	2%	0%	8%	0%
Wood Products	81%	14%	1%	3%	2%
Paper	78%	13%	0.2%	4%	5%
Printing	78%	3%	2%	12%	5%
Petroleum & Coal Products	27%	0.2%	0%	0.1%	73%
Chemicals	77%	2%	7%	12%	2%
Plastics & Rubber Products	84%	6%	1%	8%	1%
Nonmetallic Mineral Products	82%	1%	4%	7%	6%
Primary Metals	87%	3%	1%	7%	2%
Machinery	83%	0%	6%	8%	3%
Computer & Electronic Products	39%	0%	16%	36%	9%
Transportation Equipment	65%	7%	1%	17%	10%
Furniture	93%	0.3%	1%	5%	0.3%
Miscellaneous Manufacturing	60%	0.4%	8%	23%	8%
Waste and Scrap	92%	0%	0%	5%	2%
Textiles and Leather	72%	0%	1%	26%	2%
Total	**71%**	**2%**	**5%**	**14%**	**8%**

Source: FAF[2] Note: Water transportation excluded since it is close to 0.

[8] For this part of the analysis of modal dependency by industry, intermodal includes truck-rail shipments (typically containers), as well as other multiple mode shipments such as truck-water, and water-rail. Air is primarily air-truck shipments.

Evaluating modal dependency by value for outbound shipments, Table 13 shows that almost all industries use trucking as their primary mode. However, truck-dependence is less important for heavy bulk commodities that can be moved by pipeline and for goods that are traveling longer distances. Rail transportation is primarily used for exporting bulk commodities, such as stone and gravel products, plastics and rubber, beverage and tobacco, and printing. These are all heavy goods that are often less time-sensitive and tend to travel longer distances. Air transportation is typically used for lighter, higher value products and perishables such as electronics and seafood.

Table 13: Domestic Outbound Shipments and International Exports (Percent Value by Mode)

	Truck	Rail	Air	Intermodal	Pipeline & Unknown
Crop Products	96%	0%	0.4%	4%	0.1%
Animal Products	83%	0%	17%	0%	0%
Forestry & Logging	100%	0%	0%	0%	0%
Stone and Gravel	96%	3%	2%	0%	0%
Food Products	95%	0%	1%	3%	1%
Beverage & Tobacco Products	100%	0.2%	0%	0.1%	0%
Wood Products	92%	0%	0%	5%	3%
Paper	74%	0.1%	0.3%	10%	16%
Printing	76%	1%	1%	8%	15%
Petroleum & Coal Products	35%	0%	0%	0.2%	64%
Chemicals	64%	0%	10%	24%	2%
Plastics & Rubber Products	85%	2%	2%	8%	3%
Nonmetallic Mineral Products	81%	0.1%	3%	9%	7%
Primary Metals	81%	0.1%	2%	8%	8%
Machinery	84%	0%	8%	6%	2%
Computer & Electronic Products	44%	0%	19%	31%	5%
Transportation Equipment	78%	0%	8%	10%	4%
Furniture	91%	0%	0.2%	7%	2%
Miscellaneous Manufacturing	47%	0%	2%	35%	16%
Waste and Scrap	94%	0%	6%	0.0%	0.0%
Textiles and Leather	88%	0%	0.3%	11%	1%
Total	**65%**	**0.1%**	**8%**	**17%**	**9%**

Source: FAF^2
Note: Water transportation excluded since it is close to 0.

3.1.6.5 Importance of Freight and Trade to Industries

Key trade industries that are drivers of the Massachusetts economy include paper, computer and electronics, and textiles (in bold below). These are industries that are heavily involved in trade and also highly concentrated in the Commonwealth. Table 14 shows that industries that are heavily dependent on freight transportation support a significant number of jobs in Massachusetts. However, all industries are indirectly affected by freight as it provides inputs for production to businesses and goods for purchase by consumers (directly or indirectly), both of which create more demand to be met by local industries. Freight movement helps to fuel this self-perpetuating cycle that supports the economy of the Commonwealth.

Table 14: Unit Value of Freight and Industry Concentration

	Inbound ($ per ton)	Outbound ($ per ton)	Ratio Outbound/ Inbound	MA jobs	LQ
Computer & Electronic Products	35,993	125,939	3.50	69,501	2.3
Miscellaneous Manufacturing	9,199	17,085	1.86	25,068	1.5
Waste and Scrap	328	265	0.81	10,526	1.18
Paper	1,268	2,117	1.67	12,121	1.13
Printing	2,279	1,578	0.69	17,175	1.07
Textiles and Leather	10,818	25,445	2.35	16,549	1.04
Chemicals	1,894	4,516	2.38	17,293	0.86
Plastics & Rubber Products	2,432	3,165	1.30	15,774	0.84
Machinery	9,662	11,124	1.15	20,366	0.73
Food Products	1,245	1,481	1.19	23,357	0.67
Nonmetallic Mineral Products	309	298	0.96	6,937	0.57
Beverage & Tobacco Products	5,043	3,424	0.68	2,633	0.56
Primary Metals	1,630	2,868	1.76	5,543	0.52
Petroleum & Coal Products	196	333	1.70	1,162	0.45
Furniture	5,970	4,541	0.76	6,168	0.45
Stone and Gravel	21	46	2.22	1,767	0.32
Forestry & Logging	47	43	0.92	972	0.3
Wood Products	810	1,376	1.70	4,416	0.3
Transportation Equipment	10,103	12,233	1.21	11,050	0.27
Crop Products	753	989	1.31	7,519	0.21
Animal Products	2,082	1,502	0.72	1,606	0.05
Total	**1,599**	**3,685**	**2.30**	**277,503**	

Source: FAF^2, US Department of Commerce from IMPLAN

3.1.6.6 Regional Assessment of Freight Dependent Industries

A Commonwealth-level perspective is important for providing an overall view of the role of freight in the economy, but there are a number of important differences in economic profiles and the relative importance of each mode of freight transportation when sub-state regions are taken into consideration. Each of the regions considered in this study presents a unique set of freight challenges. The eastern regions of the Commonwealth rely more on just-in-time delivery for service industries and time-sensitive manufactured goods while the western regions are more involved with traditional manufacturing and rely on moving bulk commodities. These differences are important factors in determining the types of transportation investments needed for sustaining the health and supporting potential economic growth of business in each region.

This section further examines the importance of trade in Massachusetts by focusing on the freight dependence of industries at the regional level. Data for this section was developed using the TRANSEARCH database by Global Insight.[9]

Table 15 shows the percentage of each outbound good shipped by region (in descending order based on statewide tonnage totals). The differences in the Commonwealth's economy from

[9] State totals will differ due to differences in methodology from the Freight Analysis Framework (FAF^2). For instance, the FAF^2 includes pipeline transportation while TRANSEARCH does not.

east to west are noticeable in these results. The western and central parts of the Commonwealth ship most of the non-metallic products, stone and gravel, wood products and furniture produced in the Commonwealth. The eastern part of the Massachusetts ships most of the computer and electronics equipment, and petroleum and coal products. Other goods such as textiles, plastics and rubber, paper, chemicals, primary metals and fabricated metals are somewhat less concentrated by sub-state region.

Table 15: Outbound Shipments by Region of Origin (Percent by Commodity Tonnage)

	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands
Food Products	0%	18%	9%	52%	8%	12%	1%
Petroleum and Coal Products	0%	1%	5%	68%	22%	3%	0%
Nonmetallic Mineral Products	34%	47%	16%	1%	0%	1%	0%
Stone and Gravel	15%	39%	26%	12%	5%	3%	0%
Chemicals	3%	13%	19%	41%	15%	10%	0%
Paper	4%	18%	20%	37%	5%	2%	14%
Waste and Scrap	1%	14%	13%	31%	2%	37%	1%
Plastics and Rubber Products	4%	20%	20%	39%	10%	6%	1%
Computer and Electronic Products	1%	5%	8%	52%	16%	17%	1%
Fabricated Metals	1%	14%	19%	37%	12%	17%	1%
Printing	3%	9%	13%	49%	11%	15%	1%
Machinery	3%	10%	18%	47%	15%	6%	0%
Primary Metals	0%	11%	22%	26%	10%	30%	0%
Textiles and Leather	0%	5%	21%	40%	11%	22%	0%
Transportation Equipment	1%	7%	5%	65%	13%	7%	1%
Wood Products	0%	34%	11%	45%	5%	4%	1%
Miscellaneous Manufacturing	0%	33%	10%	42%	2%	11%	0%
Crop Products	0%	28%	52%	14%	1%	4%	0%
Furniture and Related Products	0%	11%	42%	40%	5%	2%	0%
Animal Products	1%	4%	5%	73%	4%	12%	1%

Source: Global Insight TRANSEARCH 2008 Release

In many cases, the key outbound goods are the reliant industries corresponding to the key inbound goods for each region. Below are several examples where the leading inbound and outbound goods can be easily linked together.

- **Chemicals** are received and used in production of the leading outbound shipments for paper in Berkshire, Pioneer Valley, central Massachusetts, greater Boston, and the Cape and Islands as well as plastics and rubber in Berkshire and the Cape and Islands.
- **Petroleum and coal** are received for use in the leading outbound shipments of chemicals in Berkshire, Pioneer Valley, central Massachusetts, greater Boston, Northeast, and Southeast.
- **Primary metals** are received for use in the leading outbound shipments of fabricated metal and computer and electronics in southeast Massachusetts.

3.1.6.7 Modal Dependency by Region

Most regions of the Commonwealth rely on trucking for a majority of their inbound and outbound shipments crossing the Massachusetts border. However, there is a clear distinction for those regions that make use of rail and those that do not. The mode usage for freight in each region of the Commonwealth[10] is presented in Table 16 and Table 17 on the basis of tonnage.

The Pioneer Valley, central, and southeast regions of the Commonwealth have noticeably higher percentages of tons moved by rail than the other regions. Greater Boston has a relatively small percentage of goods carried by rail. In the Pioneer Valley and central regions, the high percentage of rail activity is mostly attributable to the presence of intermodal rail and truck yards while the southeast region has water and rail intermodal connections in the Ports of Fall River and New Bedford. The large other category for the Cape and Islands reflects the large number of shipments to/from the island by water (ferry) and other modal combinations not captured in the traditional water shipping mode.

Table 16: Inbound Shipments by Region (Percent Tonnage by Mode)

	Truck	Rail	Air	Water	Other
Berkshire	86%	1%	0%	3%	10%
Pioneer Valley	79%	16%	0%	1%	3%
Central	68%	26%	0%	2%	3%
Greater Boston	86%	4%	0%	8%	2%
Northeast	93%	1%	0%	3%	4%
Southeast	72%	4%	0%	21%	3%
Cape and Islands	69%	0%	0%	4%	27%
Total MA	**82%**	**8%**	**0.1%**	**7%**	**3%**

Source: Global Insight TRANSEARCH 2008 Release

Table 17: Outbound Shipments by Region (Percent Tonnage by Mode)

	Truck	Rail	Air	Water	Other
Berkshire	99%	1%	0%	0%	0%
Pioneer Valley	91%	9%	0%	0%	0%
Central	82%	18%	0%	0%	0%
Greater Boston	92%	4%	1%	2%	1%
Northeast	99%	0%	0%	1%	0%
Southeast	87%	10%	0%	3%	0%
Cape and Islands	31%	0%	5%	0%	64%
Total MA	**90%**	**7%**	**0.4%**	**1%**	**1%**

Source: Global Insight TRANSEARCH 2008 Release

3.1.6.8 Importance of Freight to Regional Economies

The movement of goods is a necessary step for local industries to get products to market and receive delivery of supplies; all industries make use of freight either directly or indirectly.

[10] The analysis does not include goods moved within the Commonwealth since nearly all of them were moved by truck and traveled a relatively short distance. Comparisons of the statewide modal usage will differ due to the inclusion of pipeline freight in the FAF2 data used in the statewide analysis.

Isolating and defining freight dependence, therefore, can be challenging. This analysis identifies ~~"fr~~eight-dependent industries" as those where the importance of freight to production and operations is most direct. These include the goods-producing industries of manufacturing, mining, and agriculture. It also includes service industries that rely heavily on freight, such as utilities, construction, repair/maintenance, waste/scrap, and transportation.[11] Table 18 shows the portion of each region's economy attributed to freight-dependent industries in terms of employment and output. These industries are responsible for nearly 1.3 million jobs in Massachusetts representing 31 percent of all employment in the Commonwealth. The percentages for every region besides greater Boston are higher than the Commonwealth average. This is not surprising as greater Boston has a higher concentration of services such as education and healthcare. Berkshire and the Cape and Islands regions have the next lowest shares of freight dependent employment. These regions, along with greater Boston, are geared more towards tourism rather than heavy industry. A higher share of statewide output (40 percent) is attributed to freight-dependent industries than employment (31 percent). This means that freight-dependent industries are more productive and sell more goods and services per employee than less freight-dependent industries.

Table 18: Freight-Dependent Employment and Output by Region

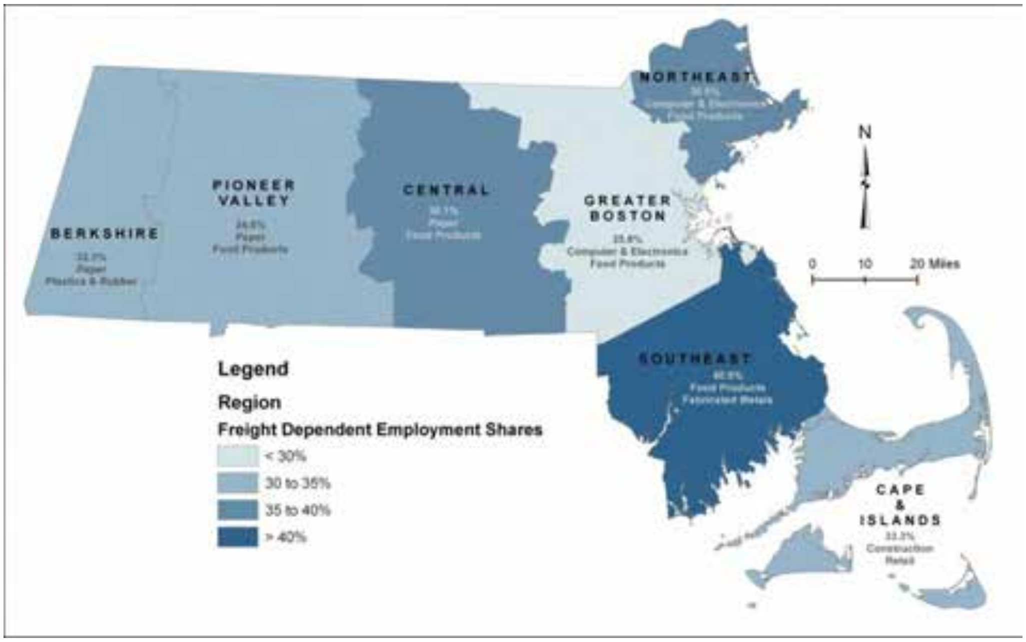
	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands	MA TOTAL
Total Industry Jobs	81,086	344,155	392,090	2,222,872	375,286	498,397	125,227	**4,039,113**
Freight Dependent Jobs	26,176	119,173	141,464	572,499	134,930	203,748	41,747	**1,239,737**
% Freight Dependent	33%	36%	37%	27%	37%	42%	34%	**31%**
Total Industry Output (mil$2006)	10,210	40,841	53,739	372,435	53,266	61,452	13,269	**605,212**
Freight Dependent Output (mil $2006)	4,385	19,020	26,641	129,963	26,302	31,023	4,619	**241,952**
% Freight Dependent	43%	47%	50%	35%	50%	51%	35%	**40%**
Output per Worker - All Industries ($2006)	125,913	118,671	137,059	167,547	141,934	123,300	105,956	**149,838**
Output per Worker - Freight Dependent ($2006)	167,512	159,597	188,322	227,009	194,928	152,261	110,651	**195,164**

Source: US Department of Commerce from IMPLAN, Calculations by EDR Group

A mapping of the percentage of regional employment in freight-dependent industries, as well as a short list of the most dependent industries, is presented in Figure 22.

[11] Transit and sightseeing transportation were not considered freight-dependent since they are primarily for passenger travel.

Figure 22: Freight-Dependent Employment by Region



Source: US Department of Commerce from IMPLAN, Calculations by EDR Group

The results for each region are summarized below. Trade flow commodity data groups are identified in bold.

Freight-Dependence in Berkshire Region

- Freight-dependent industries in the Berkshire region are responsible for 26,000 jobs and helped by the presence of I-90 and the region's close proximity to I-87 in New York.
- The largest export industries in the region are **paper** manufacturing, which contributes nearly 1,600 jobs, and **plastics and rubber** manufacturing, which contributes 776 jobs.
- The region is largely reliant on truck transportation for freight movements. This includes the shipment of **chemicals** and receipt of **primary metals,** which are used in **machinery** and **electronics** manufacturing in the region.

Freight-Dependence in Pioneer Valley

- Freight-dependent industries are responsible for nearly 120,000 jobs in the Pioneer Valley. This region has a strong highway connection for north-south movements on I-91 and east-west connections with I-90 as well as the CSX and Pan Am Railways corridors.
- Of the key outbound shipments for the region, **paper** manufacturing contributes nearly 3,600 jobs, and **food products** manufacturing contributes over 2,200 jobs. These industries are also supported by inbound shipments of chemicals and petroleum, respectively.
- Many of the key industries are dependent on rail transportation including **chemicals**, which are sent and received for use in **paper**, **printing**, **plastics** and **fabricated metal** industries.

Freight-Dependence in Central Massachusetts

- Freight-dependent industries are responsible for over 141,000 jobs in the central region. Part of this activity is driven from the existence of intermodal rail facilities in Worcester, and strong highway and rail connections in the region.

- Of the key outbound shipments for the region, **paper** manufacturing contributes nearly 3,600 jobs, and **food products** manufacturing contributes over 2,200 jobs. These industries are also supported by inbound shipments of chemicals and petroleum, respectively.
- Many of the key industries are dependent on rail transportation including **food products**, **paper**, and **chemicals,** which are shipped outside the region. The **plastics and rubber**, **fabricated metal**, **printing** and **textile** industries are also supported by chemicals received by rail.

Freight-Dependence in Greater Boston

- The greater Boston region has a lower concentration of freight-dependent industries for jobs and output than the average for the Commonwealth. In terms of size, however, it generates the largest amount of freight-dependent jobs in Massachusetts at over 572,000 (14 percent of statewide employment). The region has formidable access to highway, rail, air and water connections, and the largest consumer market in New England.
- Key export industries include **computer and electronics** and **food product** manufacturing which contribute 48,000 and 10,000 jobs to the region, respectively.
- This region mostly depends on trucking but does use rail transportation for **paper** and **chemical** outbound shipments. Chemicals received by rail are an important component of the **plastics and rubber** sector in the region. **Petroleum products** are the largest waterborne commodity in Massachusetts by tonnage and received by barge at the Port of Boston for inland distribution by truck.
- Transportation services related to freight contribute nearly 47,000 jobs to the region as it is a major hub for water and air freight activity.

Freight-Dependence in Northeast

- Half of the jobs in the northeast region are considered freight-dependent. This activity is driven by ports in Gloucester and Salem as well as the proximity to greater Boston.
- The key outbound shipments are similar to those in greater Boston. The largest employers in export industries are **computer and electronics** and **food products** manufacturing, which generate 9,000 and 4,000 jobs, respectively.
- The large construction sector (21,000 jobs) is reliant on the inbound shipment of **non-metallic minerals**, mainly by truck. Chemicals are also a key inbound shipment used in **fabricated metal**, **plastics and rubber**, and **printing** in the region.

Freight-Dependence in Southeast

- The southeast region has the highest share of freight-dependent jobs of any region at 51 percent. This is due, in part, to the existence of ports in Fall River and New Bedford, and numerous inland distribution centers.
- Key outbound goods in the southeast include **food products** and **fabricated metals,** which contribute 5,000 and 4,400 jobs, respectively.
- The region is dependent on rail transportation for the inbound shipment of **chemicals** and **food products**. Chemicals are particularly important for local **agriculture**, **textile** and **plastics and rubber** manufacturing.

Freight-Dependence in Cape and Islands

- The Cape and Islands have a lower share of freight-dependence in output and a higher share in employment relative to the Commonwealth average. The economy is predominantly tourism-based and, therefore, more indirectly involved in freight. However, all inbound goods must travel by water or air to reach Nantucket and Martha's Vineyard, so those modes are particularly critical for the islands.

- Construction and retail sectors account most freight-dependent employment with 11,000 and 20,000 jobs, respectively.

3.2 LAND USE DEVELOPMENT – ISSUES AND OPPORTUNITIES

The Massachusetts freight infrastructure comprises publicly and privately owned and operated investments. These include public infrastructure such as airports, seaports and highway corridors, and private infrastructure like freight rail, intermodal terminals and major industrial sites that are dependent on freight service to ship and receive goods. Freight infrastructure provides a critical foundation for the Commonwealth's economic competitiveness both nationally and globally.

This section of the Freight Plan is focused on land use development issues, opportunities, and potential policy recommendations. Based on a careful examination of land use conditions, a review of current policies, and intensive consultation of public and private stakeholders throughout the Commonwealth[12] the study team has identified policy issues and recommendations in three key land use development areas:

- Strategic land use planning for freight and rail;
- Freight-intensive land use preservation; and
- Expedited permitting and facilitating "shovel ready" sites.

3.2.1 BACKGROUND

Continuing globalization, major public and public/private infrastructure initiatives in competing states, and rapid structural changes in US industrial and consumer sectors requires careful re-examination of the competitiveness and productivity of Massachusetts' freight infrastructure. A major trend in Massachusetts has been the growth of services and high-tech and knowledge-based economic activity, while traditional goods-producing industries have receded, resulting in pressure to convert industrial land to residential and commercial office/retail uses.

Because freight movement takes place within a land use context—manufacturers and distributors of goods are located throughout Massachusetts in a variety of settings—this analysis examines the land use-related issues that impact freight transportation. Companies make market decisions regarding where to locate their facilities, and key considerations in these decisions are the availability of sites of the requisite size, the availability and quality of freight transportation, and proximity to markets and labor. Therefore, the availability of sites with appropriate size, access, and zoning for freight-intensive uses is an important aspect of the Freight Plan. A land use policy for freight-intensive uses should address both existing and future uses and the combination of truck, rail, air, and maritime access.

The key issue for freight-intensive uses is that while they currently are an important part of the Commonwealth's economy, other land uses that do not have characteristics benefitting from truck, rail, and maritime access are often considered the "highest and best use" for most developable land in Massachusetts, often resulting in higher property tax revenue for municipalities. These other land uses tend to predominate in the real estate market and are typically the target of most economic development initiatives. In addition, freight-intensive uses have size and activity characteristics that are often perceived as incompatible with other land

[12] A statewide stakeholders meeting on land use development and freight was held in Worcester on February 6, 2009. Meeting notes are located online at: http://www.massfreightandrailplan.com/documents/project_materials/meeting_summaries/2009/LandUseMeetingNotes-Feb_6-09.pdf

uses. The result of this combination of economic development focus and perception is that land served by rail and originally zoned for freight-intensive uses is being rezoned for other uses.

Preserving sites with good truck and/or rail access for future users of truck, rail, and maritime transportation is important and can be advantageous for the Commonwealth's economy and job creation and retention. If many of these parcels are developed for other land uses, however, the supply of parcels with appropriate access for freight (particularly rail access) will be reduced and the previous infrastructure investments to serve these properties will be diminished.

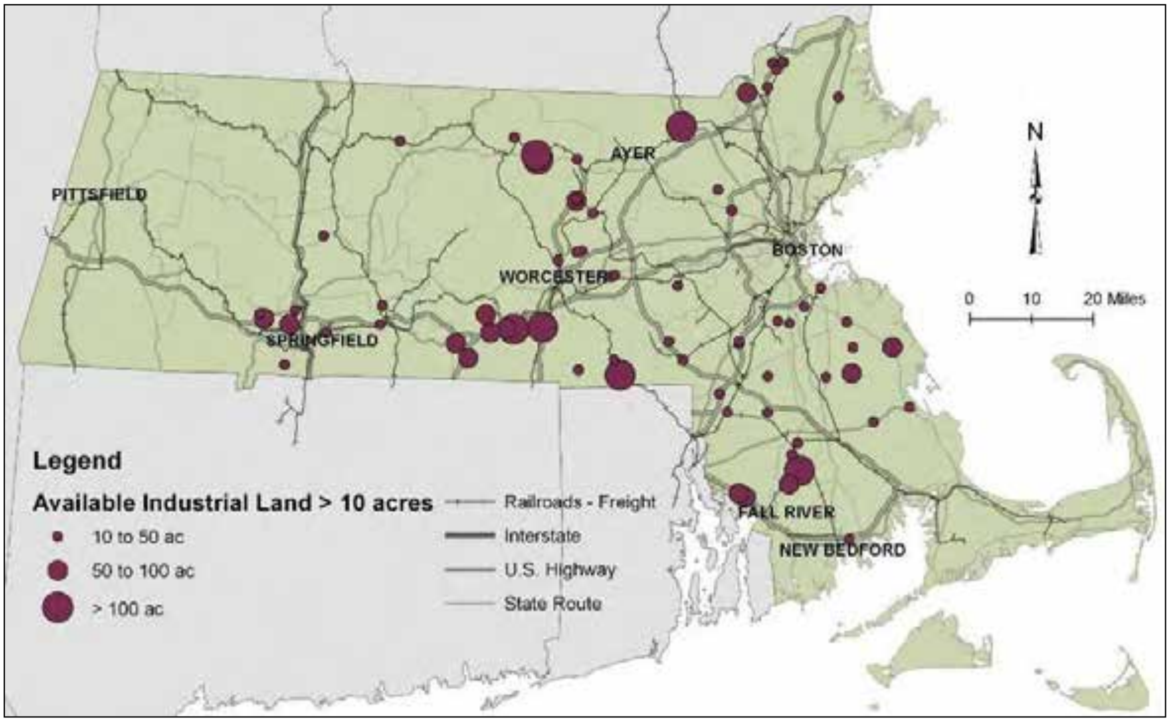
Freight rail access will become more important in the future. As any increase in fuel costs, including the costs of carbon regulations, will improve highway congestion, the economic viability of rail and possibly maritime transport for many businesses that currently rely solely on truck transport. However, even for parcels served by rail, truck access will continue to be necessary for distribution of most goods and materials.

3.2.2 CURRENT CONDITIONS AND CONSIDERATIONS

Although comprehensive information is lacking, it is clear that a broad range of industrial and distribution sites exists in Massachusetts, many of them with rail access and good highway access for trucks. They range from urban sites that have been developed for industrial uses since the 19th century—many with buildings on them—to sites near highway interchanges, both vacant and with industrial or distribution facilities on them. The latest data from the Massachusetts Alliance for Economic Development (MassEcon) SiteFinder database on large sites (10 acres or more) and rail-served sites and buildings currently being marketed for development opportunities are presented in Figure 23 and Figure 24.

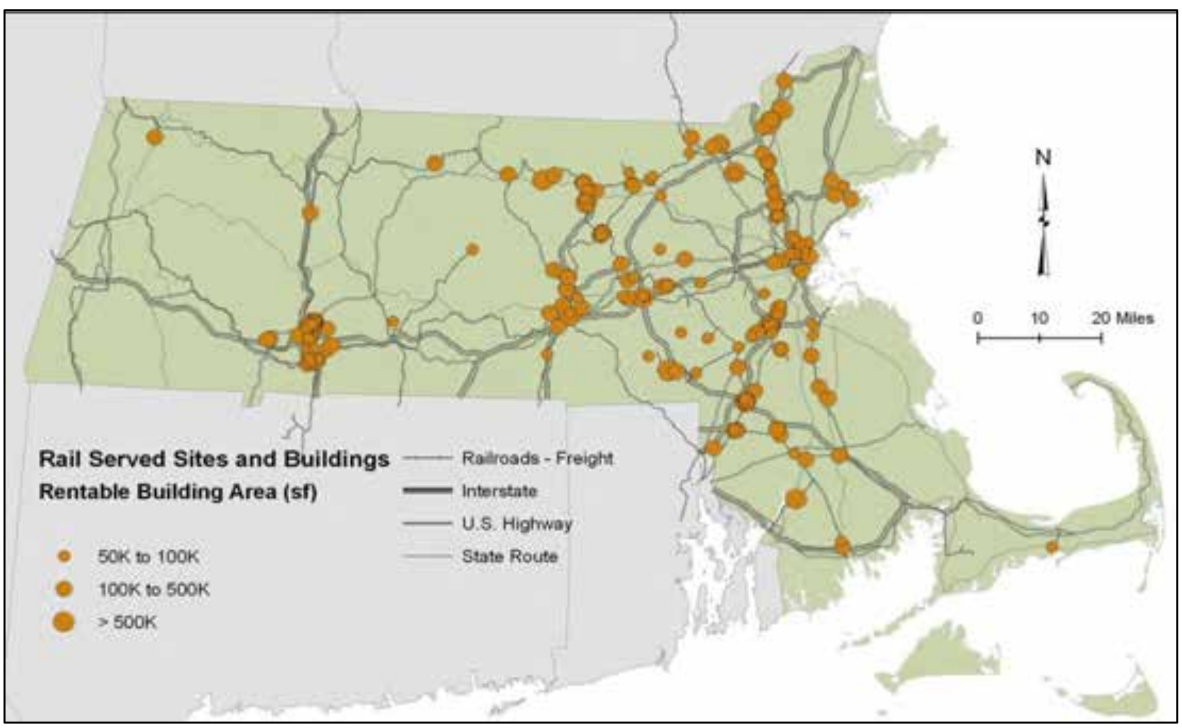
As shown in Figure 23, there are no large sites above 100 acres in the Boston metropolitan area (within I-495). Clusters of larger industrial sites are near Worcester and the Massachusetts Turnpike / CSX Main Line, with concentrations near Springfield and I-90/I-91 connections, southeastern Massachusetts, and a few large sites along the Route 2 and Pan Am rail corridor. The map of rail-served sites shows a fairly broad set of opportunities. However, some of these sites are actually along rail lines dominated by passenger rail service, with less freight service. In addition, MassEcon and their stakeholders indicate that this information includes all sites that are promoted as having rail service, but they noted that many sites may be near rail lines but without any existing rail connections.

Figure 23: Available Industrial Land Sites with 10 Acres or More



Source: MassEcon SiteFinder database (2009)

Figure 24: Available Rail Served Sites and Buildings



Source: MassEcon SiteFinder database (2009)

3.2.2.1 Freight-Intensive Land Use Conditions

Although there is obviously a significant range of site characteristics, it is useful to consider some site conditions to make the discussion of regulatory issues and incentives more specific. For example, not all existing industrially-zoned buildings with rail access are good candidates for future multi-modal freight use as the building size or location in relation to other uses may not be conducive to freight. Additionally, it may be beneficial to identify and preserve some larger-scale sites for larger-scale freight activities such as intermodal or transload sites. However, the demand for these large-scale sites is relatively limited and other smaller-scale sites with rail access could be appropriate for a wider range of manufacturing and distribution businesses.

3.2.2.2 Urban “Mill Sites”

Many of the urban sites in Massachusetts are commonly known as –mill properties” located at historic railroad junctions and or sources of water power. This class of sites, many of which are still in industrial use or storage, are adjacent to rail rights of way but may not be currently using rail service. These sites are often candidates for conversion to non-freight-intensive use for a number of reasons. The buildings, which may be historic, were designed for a production system that is now outmoded for industrial use. They may have two or more floors connected by elevators and floor plates that are quite small by current standards for either industrial production processes or goods distribution. Many of these buildings are attractive and may be suitable for conversion to residential, office, research and development, or small scale light manufacturing, or mixtures of these uses. The New Bedford Growth District is a good example of this kind of industrial conversion.

Further, demolition of existing buildings to make a site suitable for industrial or distribution buildings of modern design is likely to be constrained by competition from –smart-growth” uses, generally smaller site dimensions, and potentially the historic status and urban location of the existing buildings.

3.2.2.3 Highway Interchange Sites

There are also many existing industrial sites designated and zoned for industrial use that are located at the edges of municipalities. Many were built to take advantage of an expanding highway system. These sites are often large enough to accommodate modern industrial or distribution facilities and generally have adequate roadway connections to major highways. Because of their location at the periphery of the municipality, there may be less competition over their continued or expanded use for industrial purposes. However, many of these sites lack rail access. The sites that are currently vacant may be undeveloped because they are not well located for industrial use, particularly with regard to workforce proximity. For some sites rail access may be possible, but generally the connections would be expensive to construct and therefore unlikely to be done without a guarantee of use of the service.

3.2.2.4 Freight-Conducive Sites

A third existing condition is sites that have remained vacant despite industrial zoning and local efforts to encourage their development. These sites are generally larger (5-10+ acres), are situated adjacent to rail with a possible rail spur entering the property, are truck accessible, have buildings that may be usable for today’s industrial or distribution uses, or can be easily redeveloped. Many currently have some level of freight-intensive use, although they are not necessarily using rail at present. These sites may have the greatest potential for freight-oriented development.

3.2.3 ECONOMIC OPPORTUNITY AND MARKETABILITY

David Begelfer, the Executive Director of NAIOP, a commercial real estate development trade association, noted in an interview that the long-term outlook for manufacturing and distribution in Massachusetts is actually somewhat hopeful and the market for industrial sites location will be critical. In addition to good access, the key location feature affecting marketability is proximity to a skilled workforce. Therefore, he noted that when an industrial site has been vacant for years, the more likely reasons are: poor location in relation to workforce and major transportation corridors; impediments such as site contamination that raise the redevelopment costs, and in many cases, owners who do not appreciate the site's potential and how to market it.

Improving the quality and distribution of information relative to underused sites is critical to making them more marketable. The Massachusetts Office of Business Development and MassEcon maintain databases of available properties. A potentially helpful activity would be to conduct an inventory of sites to make sure the promising sites are identified even if they are not currently available; that is, in current use and not on the market. This is because their current use status indicates some level of market viability, and knowing the locations of these sites is the first step in efforts to preserve their availability for continued freight-intensive use. The inventory could also identify the workforce skill sets available in different regions of the Commonwealth.

3.2.3.1 Ongoing Initiatives

The Executive Office of Housing and Economic Development (EOHED) is working with communities under the Growth Districts Initiative to market parcels, assist with site preparation, and streamline permitting. However, the districts established to date are primarily planned for residential and commercial development. There are a few exceptions, such as light manufacturing as part of Lynn's growth district and an existing plastics manufacturing facility in Pittsfield. Most of the growth districts do not have rail access.

The Priority Development Sites (PDS) designated under Chapter 43 D for expedited permitting include sites identified as industrial (at least in part). A review of 29 of these sites as a sample of development opportunities being promoted by municipalities across Massachusetts suggests that many are proposed for uses such as office, research, bio-science, combinations of office, industrial, and research, or mixed uses including residential. Few have rail access; exceptions are the 7.6 acre South Worcester Industrial Park, which is surrounded by residential use, and the Stanley Business Park in Pittsfield, which has rail access but is promoting a campus-like atmosphere for non-freight-intensive uses. One large site exists, the 254-acre Westminster Business Park is near Route 2, but has no rail access and is in a largely undeveloped area. Several of the PDSs designated for industrial use are small, surrounded by residential neighborhoods, and/or occupied by mill buildings of the type discussed above under urban ―mill sites." It appears that most PDS's efforts to encourage economic development in Massachusetts are aimed at uses that are not freight-intensive and involve sites without rail access.

3.2.3.2 Siting Major Industrial and Distribution Facilities

The identification of promising sites for freight-intensive use is particularly important for large-scale sites that are well-situated in the Commonwealth's transportation network. Because these sites are apparently few in number, it is important to identify them and preserve them for near- or longer-term large-scale freight-intensive uses. These uses may include intermodal facilities connecting highway, rail, and possibly port access; major distribution facilities;

assembly/distribution facilities; and freight villages, which involve several parcels served by a common highway and/or rail access.

Officials from MassDevelopment and Chris Steele of CWS Group provided input on the site requirements for these large-scale uses. In general, major sites must have:

- Large, flat, vacant parcels of at least 10 acres (and likely larger), capable of being cleared for new construction;
- Rail access, with existing or potential sidings for trains to leave and enter a main line corridor assembled;
- Good highway access to nearby Interstate or major four-lane facilities;
- Utilities on site or nearby;
- Proximity to labor pool appropriate to the proposed use;
- Local government support for freight-intensive use on the site; and
- Potential for “buffers” around the sites and truck access facilities to limit local neighborhood opposition.

3.2.4 ISSUES AND OPPORTUNITIES

The following section describes the land use issues and opportunities that may be available to the Commonwealth of Massachusetts as it continues to evaluate and improve its existing freight infrastructure.

3.2.4.1 Strategic Land Use Planning for Freight

- Parcels of the size, location, amenities, and access characteristics suitable for freight operations are being rapidly converted to non-industrial use or isolated by development that blocks access to the freight transportation network.
- Planning for freight-oriented land use is often discounted at the local level, and has largely been undervalued at the broader Commonwealth and regional levels.
- Trends in developing high-density urban and “smart growth” initiatives for small and medium sized municipalities are putting residential and commercial development pressures on land that is currently or formerly industrial. This contributes to a decreasing supply of land and infrastructure that can support freight and logistics needs for these types of development. Current Chapter 40 programs do not include explicit considerations for the range of freight activity required to support and sustain these development trends.
- Freight planning and projects are multi-jurisdictional in nature, but local land use controls and home-rule based permitting often lead to piecemeal planning and management for freight and freight-related industrial development.
- Freight and industrial facilities of the size and scale needed to support regional freight and logistics operations are too often viewed as uses to be avoided or ignored in local planning.
- The land and building size requirements vary between different freight users.

3.2.4.2 Freight-Intensive Land Use Preservation

- Maintaining sites near airport and seaport facilities for value-added logistics support such as distribution, forwarding, and transloading activity is critical to the economic opportunities of these key trading ports and the businesses that depend on them. In Massachusetts, however, the largest marine and aviation-related activities are located in urban areas with intense competing land use interests.
- The relatively limited opportunities for rail access to industrial sites – there are 30 times as many highway miles as rail miles in Massachusetts – limits opportunities to develop

new rail-served sites, and places a premium on preserving rail access for sites where it does exist.
- Removing lands from potential residential and/or commercial development can negatively affect the revenue producing capability of publicly or privately controlled lands.
- Logistical support for high-tech and life sciences, and the provision of competitively priced consumer goods and services (especially with the potential for higher future fuel costs) for the high-income populations that are drawn to these clusters depend on the availability of freight distribution centers and facilities within close proximity to these activities.
- Achieving lower and sustainable air emissions and avoiding highway congestion from avoidable long-haul, truck-intensive logistics systems requires rail-served intermodal support facilities as close to populations and market centers as possible.

3.2.4.3 Expedited Permitting and Facilitating "Shovel Ready" Sites

- Federal (NEPA) and Massachusetts (MEPA) environmental and permitting processes are significant hurdles. The Chapter 43D program is a Commonwealth program that can help to accelerate local permitting.
- Hazardous and brownfield mitigation risks often delay or add significant costs to site preparation, certification, and development.
- Local land use controls, zoning, and orders of conditions can complicate the development process, making out-of-state, shovel-ready sites more attractive to large-scale development needed to support logistics operations.
- Other states are promoting programs to identify and facilitate development at "shovel ready" sites at industrial parks and other locations. For example, Virginia and Missouri have state programs to identify industrial properties and qualify those sites based on rail access, incentives, and other factors relevant to site selection decisions. To stay competitive Massachusetts continues to look for ways to expedite permitting and site development through early review of sites and promotion of industrial initiatives (e.g., master plan for an industrial park) to mitigate issues and accelerate development potential.

3.2.5 POLICY AND REGULATORY FRAMEWORK

The following provides a review of current land use policies and regulations related to freight. Additionally, it describes how they may be used to better support freight-intensive land use development where appropriate.

3.2.5.1 Municipal Authority in Land Use Regulation

In Massachusetts, most regulation of land use and development is reserved to the municipalities (with some exceptions on Cape Cod and Martha's Vineyard, which have some regional development review). Local land use regulations are established by a two-thirds vote of the local legislative body and attempting to override local land use authority can be challenging.

Local power to regulate development is both enabled and limited by Commonwealth law, particularly Chapters 40A, 40B, 40C, 40R, and 43D, which pertain to zoning and development regulation, and Chapter 41A Section 81K-GG, which governs local subdivision control. These laws have given municipalities an option to adopt provisions that serve a particular purpose. Examples are the authority to coordinate and expedite local permitting (Chapter 43D) or to promote certain forms of development deemed to be "smart growth" (Chapter 40R) by a comprehensive permitting approach. The notable exception to the Commonwealth legislation *enabling* municipal authority is Chapter 40B, which allows local impediments to affordable housing to be *superseded* through a process ending with the Commonwealth's Housing

Appeals Board. It is unlikely that an analogue to Chapter 40B for the purpose of encouraging freight-intensive development would be successfully enacted. Therefore, the approaches discussed here are measures that provide incentives rather than mandates for municipal action to promote freight-intensive uses.

3.2.5.2 Commonwealth Regulations That Limit Land Use

At the Commonwealth level, regulations that directly limit development are closely tied to specific natural resources such as wetlands and tidelands and, to a lesser extent, significant historic and archeological resources. The Designated Port Area regulations have a function similar in intent to some approaches to preserve inland sites with rail access but are tied to Chapter 91 regulation of tidelands, administered by the Department of Environmental Protection. The Massachusetts Environmental Policy Act (MEPA) is a Commonwealth-level review of public and private projects that exceed stated thresholds of size or activity and would apply to most development or redevelopment of freight-intensive uses; MEPA is discussed in more detail below.

3.2.6 LAWS THAT COULD SERVE AS MODELS FOR LEGISLATION TO PROTECT AND FACILITATE FREIGHT-INTENSIVE LAND USES

The following discussion explores existing laws that could serve as models for potential new legislation with an assessment of which ones are not likely to be applicable to freight.

3.2.6.1 Chapter 61A – Assessment and Taxation of Agricultural and Horticultural Land

<u>Type of Approach</u>: Remove tax incentive to change from a desired land use.

<u>Mechanism:</u> Chapter 61A is intended to encourage agricultural use of land and discourage its development. It does this by providing a standard for local assessors to use in valuing land, which has been in agricultural use for at least three years; the assessment for property tax is at its agricultural use value rather than its value as a development site. There is a conveyance tax on land that has been so valued and then taken out of agricultural use. The tax is on a declining basis keyed to the number of years since the agricultural valuation commenced, 10 percent if sold or converted in the first year of ownership declining to zero after ten years.

<u>Is it applicable to freight-intensive land uses?</u> The analogous treatment of industrial land would be fairly complex, but it would involve a property already in specific industrial use or freight-intensive uses being assessed according to the property's value in *this* use as opposed to assessment at a different higher and best use if redeveloped, for example, as residential or office. If the local zoning did not permit these other uses (i.e., if the land was restricted to industrial use) the valuation should already be based on industrial use and there would be no need for this approach. If, on the other hand, the land were rezoned to residential or other non-freight-intensive use, there would be a conflict between the will of the local legislative body and the objective of preserving industrial use. As discussed above, it is not politically realistic to override local land use authority, so encouraging a land use contrary to the intent of the rezoning would not be appropriate. Therefore, the approach would be applicable primarily in situations where the zoning is permissive and allows a range of uses, including industrial. Although zoning sometimes allows industrial and commercial uses such as office in the same zoning district, the analogy to agricultural land (which is usually zoned for both agricultural and residential use) is not a sound one. It is difficult to zone for agriculture and exclude all other uses on agricultural land, but relatively easy to zone land for freight-intensive uses. Therefore, simply zoning to permit industrial use is more straightforward than using special taxation rules to encourage industrial land preservation.

Accordingly, a Chapter 61A analogue is not likely a fruitful approach to industrial land preservation.

3.2.6.2 Chapter 40L – Agricultural Incentive Areas

Type of Approach: Provide a first option for public acquisition prior to change from a desired land use.

Mechanism: This law gives municipalities the option to designate agricultural land as an "Agricultural Incentive Area." Once the designation has been approved by a two-thirds vote of the municipal legislative body, sale or conversion to non-agricultural use requires notice from the owner in order that the municipality (or Massachusetts Department of Food and Agriculture) be afforded the first option to purchase the property at its appraised full-market value.

Is it applicable to freight-intensive land uses? The rationale for Chapter 40L is that it allows land to remain in a desirable land use under private ownership but allows the public sector to acquire the land before its use is changed. An analogous mechanism for land in freight-intensive use could be considered to give the municipality or the Commonwealth a first option on identified strategic parcels for freight-intensive use. This would require that the land be first identified in a comprehensive inventory as a parcel of strategic importance; this would be analogous to the designation process under Chapter 40L and would be performed by EOHED.

Since property taxation is an important local prerogative, the analogous mechanism for strategic industrial parcels would be adopted by the local government and would include a provision that the parcel be assessed and taxed at its value for industrial use rather than a more intensive non-industrial use. The authority to exercise the option to purchase would be assigned to a local authority (a redevelopment authority or industrial finance authority with the power to acquire and hold property) or alternatively to MassDevelopment. Local adoption would be facilitated if the municipality could receive payments in lieu of taxes if the acquiring entity is MassDevelopment. If the acquiring entity is a local authority, infrastructure improvement grants such as those provided by the Growth District Initiative would help to provide an incentive for local adoption as well as improvements to attract freight-intensive uses. Based on this assessment, this program should be considered as a means to preserve industrial and freight uses.

3.2.6.3 Chapter 40R – Smart Growth Zoning Districts

Type of Approach: Provide a zoning approach and financial incentives to encourage a particular type and density of land use.

Mechanism: Chapter 40R's purpose is to encourage the adoption of overlay districts providing higher residential density and a mix of land uses at appropriate locations, such as near transit stations. Direct incentive grants are provided to municipalities for adopting these districts, which must be pre-approved by DHCD, and for the housing created in them. Chapter 40S provides additional school funding to close any gap between the municipalities' tax revenues from the smart growth district and the school costs that result from the new housing.

Is it applicable to freight-intensive land uses? Freight-intensive uses are by nature not part of these districts because they are extensive, not intensive, land uses. An analogous zoning mechanism to promote freight-intensive land uses would not be appropriate because the size of these uses and the presently weak market for them in Massachusetts would not provide any advantage over a parcel-oriented approach that provides site improvement incentives for specific freight-intensive uses. Municipalities that wish to attract freight-intensive uses can do so through appropriate zoning under Chapter 40A, the Zoning Enabling Act. Financial and permitting incentives are discussed below under approaches to facilitate development of suitable sites.

3.2.6.4 Chapter 91 – Waterways Licenses; Designated Port Areas (DPAs)

Type of Approach: Prohibit change in use for parcels that have been designated as being of strategic importance for a specific function.

Mechanism: By law, tideland belongs to Massachusetts and can be used only with a license from the Commonwealth. Maritime facilities officially listed as DPAs pursuant to Chapter 91 may not be changed to a non-maritime use without a license granted under the Chapter 91 program, which is needed for any development or change of use in the tidal zone (e.g., on piers) or on ―filled tidelands,” which are areas of tideland that have historically been filled.

Is it applicable to freight-intensive land uses? An approach analogous to DPAs would be to perform a Massachusetts-wide inventory of strategically located *inland* parcels of adequate size that have good rail and truck access, designate these as ―Designated Freight Areas,” and allow no other type of use within them. The problem with this approach is that in the case of DPAs, the Commonwealth has a prior claim to the land, and development for non-port uses is regulated under Chapter 91. Designating privately owned inland parcels in this manner would be viewed by the courts as a taking requiring the owner to be compensated. Strategic Commonwealth purchase of key industrial properties would be the more straightforward approach to preserving it for freight-intensive use. In addition, there is not an applicable regulatory mechanism analogous to Chapter 91 to provide a framework for reviewing development within the designated freight areas.

This is not a promising approach.

3.2.7 POTENTIAL REGULATORY CHANGES

3.2.7.1 Chapter 43D Expedited Permitting for Commercial and Industrial Development

Type of Approach: Facilitate development of desired uses.

Mechanism: Chapter 43D provides an optional local permitting process to facilitate commercial and industrial development, including mixed use development. After local legislative acceptance and the conforming of local regulations, all local development-related permits (including wetland and board of health permits) can be applied for with a single application and local approvals/denials must occur within 180 days. This process applies only to Priority Development Sites (PDSs) approved by the Commonwealth-level Interagency Permitting Board. Technical assistance grants to the municipality are provided, and approved PDS developments get priority consideration for several Massachusetts' grant programs (CDAG, PWED, etc.) and quasi-public financing. MEPA and MHC reviews take place *concurrently* with local permitting and are supposed to conclude within 120 days. Of note, the current list of PDS in the Commonwealth includes few, if any, sites consistent with freight-intensive uses.

Is it applicable to freight-intensive land uses? Maintaining freight access could be added to the criteria for PDS designation. This would need to be done in a way that does not make development more difficult, as that would be counter to the purpose of 43D. The regulations could be amended to provide priority consideration for a grant program that benefits freight-intensive uses by funding planning efforts (including investigations of site contamination) for industrial Priority Development Sites served by rail. They could also incorporate a requirement to maintain rail access.

3.2.8 CHANGES THAT COULD BE IMPLEMENTED THROUGH AGENCY POLICY OR EXECUTIVE ORDER

3.2.8.1 The Massachusetts Environmental Policy Act (MEPA)

Type of Approach: Ensure that stated policies used to regulate development are inclusive of freight transportation in accordance with regulations for minimization of impacts.

Mechanism: MEPA is a Commonwealth-level review of environmental impacts for projects that exceed thresholds related to criteria such as land alteration, creation of impervious area, and traffic generation. The scope of MEPA review includes all relevant categories of impact for Commonwealth agency projects or projects that receive financial assistance from the Commonwealth, but only those areas covered by Massachusetts permits for private projects that do not receive financial assistance. Unlike the National Environmental Policy Act (NEPA) after which it is modeled, MEPA does not address social and economic impacts. MEPA does not prohibit projects but requires the analysis of alternatives that would reduce impacts and commitments by the project proponent to implement specific mitigation measures to address the project's impacts. MEPA requires a public process that affords opportunities for agencies, local governments, interested parties, and the public to comment and receive responses from the proponent. It is therefore an opportunity for input on the manner in which a site is to be developed, particularly with regard to issues such as whether the site layout would allow later use of available rail access instead of precluding it.

Is it applicable to freight-intensive land uses? No changes would be needed to the current MEPA regulations for proponents of rail access to provide comments during reviews of projects on sites suitable for freight-intensive use. An executive order from the governor would give this consideration substantial weight, even in the absence of agency or advocacy group comments. This is similar to the use of the Commonwealth's Sustainable Development Principles in MEPA review or the requirement by MEPA to address pedestrian and bicycle access in the Draft Environmental Impact Report (DEIR), and to take a harder look in the Final EIR if the DEIR treatment was determined to be inadequate. These considerations are often voluntarily incorporated in project design by the proponent if financially feasible. While proponents could provide reasons why they rejected alternatives that would afford future rail access, they would need to address the issue, and it would be possible to incorporate this into the MEPA process.

A regulatory change making loss of rail access to industrial parcels a threshold for MEPA review is unnecessary because development of parcels of significant size would normally trigger MEPA review under other thresholds currently in the regulations.

There are precedents for pre-permitting under MEPA, although not explicitly described in the regulations. On Commonwealth Flats in Boston, Massport filed an EIR for the master plan for development of multiple parcels of land in an area of approximately 100 acres owned by the Authority; the EIR was based on an assumed maximum build-out of all parcels, analyzing all impact categories. Individual parcel developments were treated as Notices of Project Change (NPC), but these NPC reviews were relatively simple and brief as long as the individual projects were within the maximum impact envelope on which the master plan EIR was based. This approach does not require modification of the MEPA regulations.

MEPA assistant director Rick Bourré indicated that MEPA attempts to be flexible and work with the proponent to select a review procedure that is mutually acceptable. This could be a generic EIR for a development district whose proponent is a development authority, or it could be a Special Review Procedure in which individual phased projects file Single EIRs (as opposed to Draft and Final EIRs) based on an Environmental Notification Form (ENF) for the entire district. Both options would expedite MEPA review as long as the individual projects fit within the envelope of impacts originally submitted.

In the case of freight-intensive uses, the proponent for master plan review would be a redevelopment authority or municipal industrial finance authority that has the ability to make mitigation commitments.

3.2.9 KEY FINDINGS

3.2.9.1 Legislative Options

1. The control of land use in Massachusetts is vested primarily in local governments. Commonwealth laws give municipalities certain options they can choose to adopt, but it is inappropriate for the Commonwealth to attempt to impose requirements on local governments for any purpose, including a requirement to reserve parcels with rail access and good truck access for freight-intensive uses. This includes legislation analogous to Chapter 40B, which provides a process to override local regulations as necessary for the development of affordable housing.
2. Except on Cape Cod and Martha’s Vineyard, regional review of land use decisions of regional or Commonwealth importance is not politically viable.
3. Chapter 40R ―Smart Growth” districts do not provide a useful model to promote the development freight intensive land uses.
4. Chapter 61A, Assessment and Taxation of Agricultural Land does not provide a useful analogue for industrial parcels because of the difference in zoning exclusively for industrial use, which is commonly done, versus agricultural use, which is generally not possible to zone as an exclusive use.
5. Chapter 40L, Agricultural Incentive Areas, provides a model that could be used to give the public sector a first option to buy parcels of importance for freight-intensive uses when a change from industrial use is proposed or the parcel is to be sold to a new owner, but it could be difficult to justify such expenditures for private business enterprise.
6. Chapter 91, which provides for licensing of development on filled tidelands and protection of Designated Port Areas, does not provide a useful analogue for inland parcels of strategic importance for freight-intensive uses, because the Commonwealth has a prior claim on tidelands but not on inland parcels.

3.2.9.2 Regulatory Options

1. The regulations for Chapter 43D, Expedited Permitting, could be modified to make suitability for freight-intensive uses an optional criterion for Priority Development Sites and to require rail access to be maintained in such sites.
2. Changes in the MEPA regulations are not necessary to review master plans for industrial districts or sites as long as there is a Commonwealth or municipal entity such as a redevelopment authority that can make mitigation commitments; final review of industrial development projects covered by the master plan would be performed under Notices of Project Change, which would be relatively simple if the actual development remained consistent with the master plan’s assumptions.

3.2.9.3 Agency Policies and Executive Orders

1. EOHED and MassDOT could adopt a policy that would include development of freight-intensive uses and use of existing rail access as new or optional criteria for the Growth District Initiative, Chapter 43D Priority Development Sites, and MEPA review.
2. An Executive Order requiring consideration be given to maintaining existing rail access on parcels suitable for freight-intensive development would give additional weight to the policy as an element in MEPA review.

3.2.9.4 Pre-Permitting

1. MEPA, as noted above, affords an opportunity for master plan review that is essentially pre-permitting of an area with more than one site based on assumed traffic generation and layouts with respect to wetlands, habitat, and other permitting considerations. This would take the form either of a Generic EIR on the district master plan, or a Special Review Procedure with a Single EIR on each project phase.
2. Since freight-intensive uses are varied in type and size, it is difficult to characterize the impacts of a specific development for zoning or site plan review purposes until the specific user is known; therefore, pre-permitting is difficult for the level of review, but the expedited permitting process under Chapter 43D would facilitate local permitting.

A complete set of more fully-developed policy recommendations for land use development and freight are included in Chapter 5 and the Executive Summary.

3.3 COMMODITY TRADE FLOW ANALYSIS

To understand the existing conditions and future needs of the freight system in Massachusetts a thorough examination of the commodities traveling within and through the Commonwealth, as well as the modes of transportation is required. Thus, this section offers a detailed evaluation of current commodity flows traveling on the Commonwealth's infrastructure and major freight routes. Included in this evaluation is data and information gathered from key shippers within Massachusetts who originate and receive goods. Forecasts of future freight flows and demand are also presented.

The trade flow analysis covers all goods movement in Massachusetts and captures the following four major types of trade flows:

- **Inbound:** Goods originating outside of Massachusetts with a destination in Massachusetts;
- **Outbound:** Goods originating in Massachusetts with a destination outside of Massachusetts;
- **Internal**: Goods that have both an origin and a destination in Massachusetts; and
- **Through:** Goods that have both an origin and a destination outside of Massachusetts, traveling through the Commonwealth, and along its infrastructure.

There are two primary data sources used in the trade flow analysis:

1) **Global Insight TRANSEARCH trade flow data.** This is a detailed, county-level data set purchased specifically for this Freight Plan. It covers all goods movement (inbound, outbound, internal, and through-trips) across all modes by tonnage for the year 2007. It includes information on trade flows for origins and destinations that are external to Massachusetts. Forecasts of freight flows in Massachusetts were obtained in 2009 to provide the most up-to-date forecasts available.

2) **Federal Highway Administration – Freight Analysis Framework (FAF).** The FAF data is publicly available with geographic coverage of states and major metro areas (but not county-level in most cases). The FAF historical data is also for 2007 and earlier forecasts produced in 2005 provide alternative future freight flow demand scenarios to 2035. The FAF provides data for both tonnage and value and thus is the source of data for commodity flow by value. However, it does not cover through-trips. This is noted as a key limitation of the data.

Finally, it is important to define what a trade flow means in terms of this data analysis. Each individual goods movement presented and aggregated below represents a single flow from an origin to a destination, and in almost every instance, it represents a single modal shipment. As an example, if a container of food products arrives at the Port of Boston from an international destination or from a marine shipping company, and is then distributed within Massachusetts, that could be counted multiple times within the data. An example is presented below:

- First, the inbound container to the Port of Boston is a water-based commodity to the Commonwealth;
- Second, the container may be drayed from the Port of Boston to a distribution facility; and
- Third, the food products are then distributed to retailers within the Commonwealth or nearby markets in other states.

Similar examples hold for other modes and types of shipments as many products now travel via multiple modes to reach their ultimate destination, thus accentuating the need for an integrated and efficient intermodal and multi-modal freight system.

The remainder of the trade flow analysis is divided in the following sections:

- Overview of freight flows and modal share;
- Statewide commodity flow analysis;
- Modal freight flow assessment;
- County and regional analysis of freight flows;
- Summary of findings from shipper interviews and stakeholder input; and
- Forecast of future freight demand.

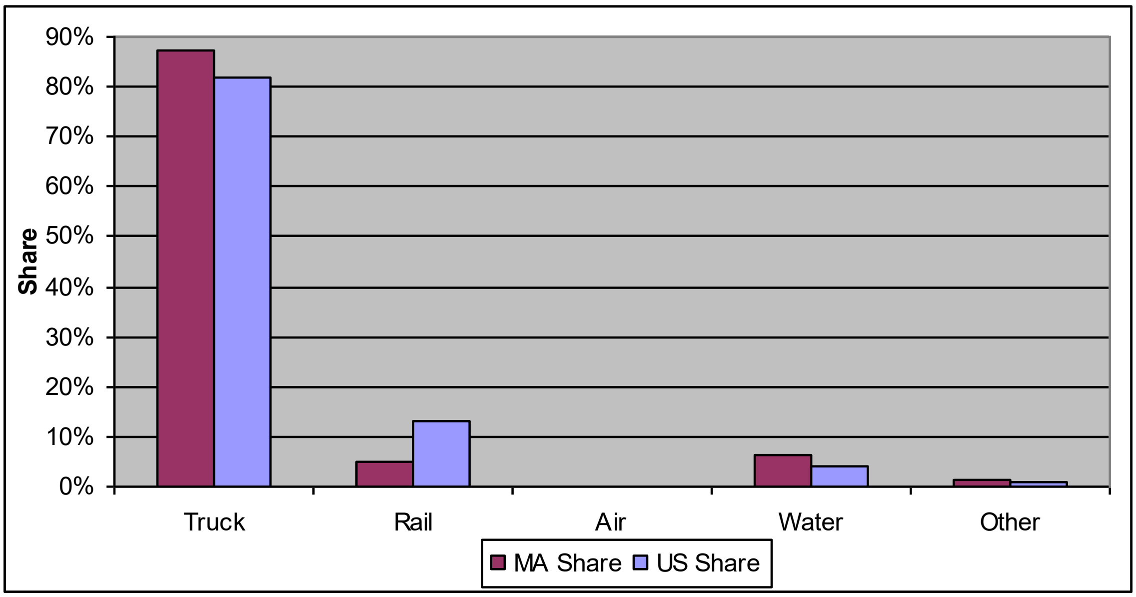
3.3.1 OVERVIEW OF FREIGHT FLOWS AND MODAL SHARE

Just over 278 million tons of freight were transported on the Commonwealth's infrastructure in 2007.[13] Freight moving through Massachusetts travels by truck, rail, air, water, or a combination of the above.[14]

[13] Provided by Global Insight's TRANSEARCH database.

Massachusetts is more heavily reliant on trucks and less on rail than the US for goods movement (see Figure 25).[15] While Massachusetts moved 87.2 percent of its freight tonnage by truck, the average US share is 81.7 percent. The US relies substantially more on rail than Massachusetts, with shares of 12.8 percent and five percent respectively. Air freight is a very small share of modal movements by tonnage, at 0.1 percent for both Massachusetts and the United States. Massachusetts is more reliant on water as a means of movement than the national average as it leverages its coastal location and port facilities.

Figure 25: 2007 Modal Shares of Tonnage for All Freight Movements Excluding Through Traffic, Massachusetts and US



Source: Global Insight TRANSEARCH 2008 Release, FAF^2 2007 Provisional Release
Notes: Does not include through-trips; other includes Other Intermodal Movements.

Table 19 provides a breakdown of freight movement by mode and direction, including through-trips for freight in Massachusetts. Consistent with the overview of modal movements, the vast majority of freight movement is by truck, regardless of direction. Inbound traffic to Massachusetts has the lowest truck share at 78.4 percent. Inbound truck traffic carries the most freight tonnage in Massachusetts reflecting both the nature of our economy (shifting away from producing heavy commodities) and the strong consumer demand of our residents. In addition, the majority of all water freight comes inbound to the Commonwealth in terms of total tonnage and percent share.

For rail, inbound shipments are more than three times higher than outbound from Massachusetts. Internal and through movements are most likely to be on a truck given the shorter distance of shipments, with trucks moving 99 percent of freight within the Commonwealth and accounting for 81 percent of through traffic. For through-trips, rail is

[14] Commodities traveling via pipeline were not included in this analysis, as the focus of this report is on freight surface transportation.
[15] Note that US Modal Share is based on the FAF^2, while Massachusetts is based on TRANSEARCH. The FAF^2 data shows MA relying more heavily on truck than TRANSEARCH, with shares of 95.5% truck, 3.1% rail, 0.4% water, 0.1% air, and 0.9% other/intermodal.

estimated to capture almost 13 percent of goods movement as the rail mode is most competitive for longer-distance shipments.

Table 19: Massachusetts Freight Tonnage by Mode and Direction (Thousands of Tons), 2007

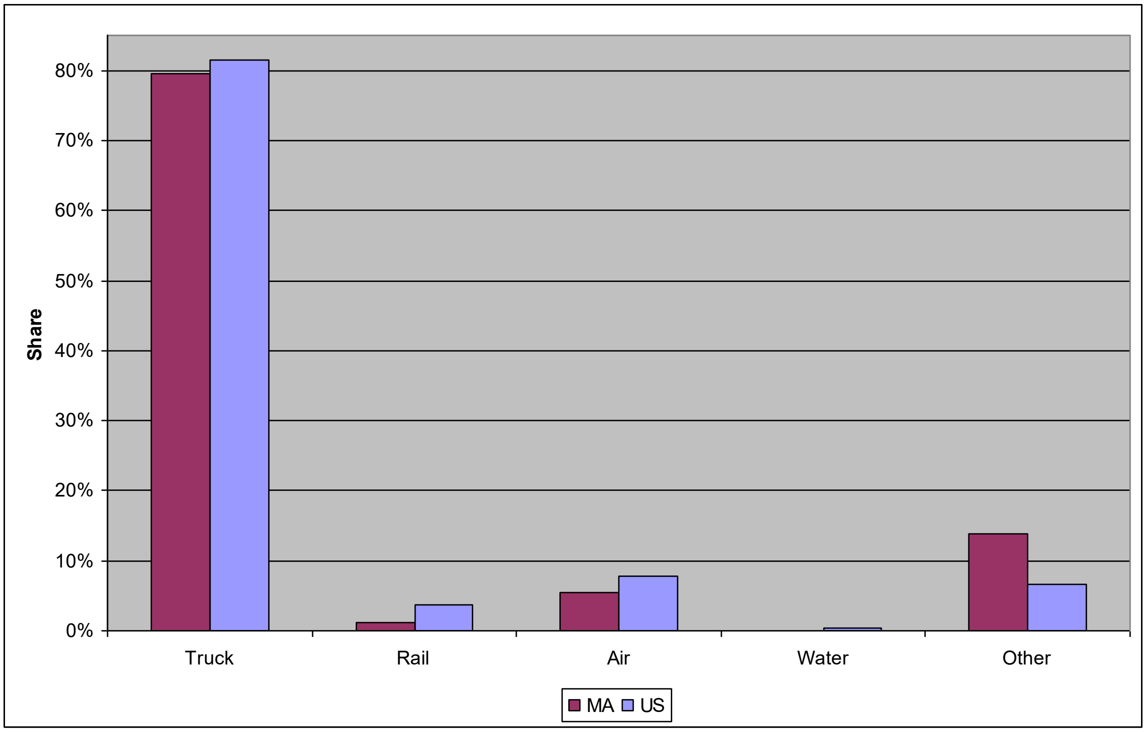
	Inbound		Outbound		Through		Internal		Total	
	Tons	% Share	Tons	% Share	Tons	% Share	Tons	% Share	Tons	% Share
Truck	89,006	78.4%	31,310	89.9%	43,367	81.3%	75,633	99.12%	239,316	86.1%
Rail	8,542	7.5%	2,579	7.4%	6,764	12.7%	57	0.07%	17,942	6.5%
Air	162	0.1%	154	0.4%	-	0.0%	2	0.00%	318	0.1%
Water	12,886	11.3%	356	1.0%	-	0.0%	615	0.81%	13,857	5.0%
Other	3,002	2.6%	447	1.3%	3,220	6.0%	-	0.00%	6,669	2.4%
Total	**113,599**		**34,846**		**53,351**		**76,307**		**278,103**	

Source: Global Insight TRANSEARCH 2008 Release

The *value* of freight traveling on the Commonwealth's infrastructure, excluding through traffic, is 2.8 percent of the total freight value moving in the US. By comparison, the total number of tons shipped in Massachusetts is 1.8 percent of the total tonnage shipped in the US meaning that the value per ton shipped is higher in Massachusetts. The modal share in terms of commodity value for Massachusetts and the United States is shown in Figure 26. One of the main reasons that a greater share of value moves to and from Massachusetts, as compared to tonnage, is because of the light, high-valued commodities produced within the Commonwealth.

The percentage of value moved by truck is still the largest modal share, transporting 79.5 percent of all freight value in Massachusetts but is actually lower than the US share, in contrast to the data by tonnage. Commodities moving by other modes such as air and other (intermodal) tend to have a higher value-to-weight ratio indicated by their higher shares. For example, air shipments in Massachusetts carry 5.5 percent of the total freight value while only carrying 0.1 percent of the total freight tonnage.

Figure 26: Modal Share of Value, Massachusetts and the US, 2007



Source: FAF[2] 2007 Provisional Commodity Origin-Destination Data Release

The total dollar amount of freight shipped within Massachusetts has increased by 8.2 percent between 2002 and 2007, with the growth primarily in air and truck shipments. Of the approximately $386 billion of freight that moves in Massachusetts, $307 billion is moved by truck alone. Of the total value, $168.9 billion is attributed to goods originating in Massachusetts and $142.4 billion is the value of goods terminating in Massachusetts. Although more freight tonnage terminates in the Commonwealth, the high value of goods that originate in Massachusetts means that it is a net exporter of value.

3.3.2 COMMONWEALTH-WIDE COMMODITY FLOW ANALYSIS

This section provides a detailed commodity flow analysis across all modes in terms of tonnage, value, commodities, and the shipping patterns of major commodities for the Commonwealth of Massachusetts. This analysis facilitates and understanding of the total demand for goods movement across all modes, which can be used to better assess each mode and its role in the overall freight system.

3.3.2.1 Freight Flows by Tonnage

The commodity freight flow by tonnage focuses on the top ten commodities that are transported on the Massachusetts infrastructure. The data contained in this section is primarily from the TRANSEARCH database, where each commodity is classified using the Standard Transportation Commodity Classification Code (STCC) system. The data includes commodity information by tonnage, mode, origin, and destination for the year 2007. The freight flows covered in this section include inbound, outbound, internal, and through-trips.

The most moved commodities in Massachusetts by tonnage, regardless of direction, are petroleum and coal products, with more than 41 million tons accounting for 14.8 percent of all freight as shown in Table 20. This category is followed by secondary traffic and nonmetallic minerals, which account for 14.0 percent and 12.6 percent of all movements respectively. Secondary traffic (truck distribution) is a distribution category of all commodity flows that represent freight movement from wholesalers, warehouses, and distribution centers, and drayage for rail terminals and airports.

Table 20: Top Ten Massachusetts Commodities for All Modes (Millions of Tons), 2007

Commodity	Total Tons	% Share
Petroleum or Coal Products	41.1	14.8%
Secondary Traffic (Truck Distribution)	38.8	14.0%
Nonmetallic Minerals	35.2	12.6%
Food or Kindred Products	32.3	11.6%
Chemicals or Allied Products	29.3	10.5%
Clay, Concrete, Glass or Stone	27.1	9.8%
Pulp, Paper or Allied Products	14.7	5.3%
Primary Metal Products	9.4	3.4%
Lumber or Wood Products	7.5	2.7%
Fabricated Metal Products	5.6	2.0%
Total Tons	**278.1**	**86.7%**

Source: Global Insight TRANSEARCH 2008 Release

The top commodities by direction moved, inbound, outbound, internal, and through, are presented in Table 21 through Table 24. For all four directions, secondary traffic is within the top ten, and in the case of outbound and internal movements, it is the top commodity. Other goods that are in the top ten for all directions include food or kindred products, petroleum or coal products, nonmetallic minerals, clay/concrete/glass/stone, and chemicals or allied products. These goods tend to be heavier and moved in bulk.

For inbound commodities, food or related products and chemicals or related products account for most of the tonnage (15.8 percent and 15.6 percent, respectively), while petroleum and coal products and nonmetallic minerals combined account for slightly more than one-quarter of all tonnage.

For outbound commodities, other than secondary traffic (truck distribution), the tonnage consists mostly of bulk materials such as petroleum or coal products, nonmetallic minerals, and clay, concrete, glass or stone. Together, these commodities account for nearly 33 percent of all outbound tonnage.

For intrastate freight movements (that originate and end in Massachusetts), bulk commodities play a large role within the Commonwealth. Petroleum and coal products, clay, concrete, glass or stone, and nonmetallic minerals account for nearly 63 percent of all tonnage.

For commodities passing through Massachusetts the largest categories are food and food products (15.9 percent), pulp/paper products (15.6 percent) and chemicals and chemical products (14.3 percent).

Table 21: Top Ten Commodities Outbound from Massachusetts for All Modes (Millions of Tons), 2007

Commodity	Total Tons	% Share
Secondary Traffic (Truck Distribution)	6.0	17.2%
Petroleum or Coal Products	4.1	11.8%
Nonmetallic Minerals	3.9	11.1%
Clay, Concrete, Glass or Stone	3.4	9.7%
Food or Kindred Products	3.3	9.6%
Chemicals or Allied Products	2.9	8.3%
Pulp, Paper or Allied Products	2.5	7.2%
Waste or Scrap Materials	1.5	4.3%
Rubber or Miscellaneous Plastics	1.1	3.0%
Fabricated Metal Products	1.0	3.0%
Total Tons	**34.8**	**85.0%**

Source: Global Insight TRANSEARCH 2008 Release

Table 22: Top Ten Commodities Inbound to Massachusetts for All Modes (Millions of Tons), 2007

Commodity	Total Tons	% Share
Food or Kindred Products	17.9	15.8%
Chemicals or Allied Products	17.8	15.6%
Petroleum or Coal Products	15.9	14.0%
Nonmetallic Minerals	14.9	13.1%
Secondary Traffic (Truck Distribution)	8.1	7.2%
Primary Metal Products	5.9	5.2%
Lumber or Wood Products	5.0	4.4%
Clay, Concrete, Glass or Stone	4.5	4.0%
Pulp, Paper or Allied Products	3.6	3.1%
Crude Petroleum or Natural Gas	3.0	2.6%
Total Tons	**113.6**	**85.0%**

Source: Global Insight TRANSEARCH 2008 Release

Table 23: Top Ten Commodities Internal to Massachusetts for All Modes (Millions of Tons), 2007

Commodity	Total Tons	% Share
Secondary Traffic (Truck Distribution)	20.8	27.3%
Petroleum Or Coal Products	17.3	22.7%
Clay, Concrete, Glass Or Stone	15.9	20.9%
Nonmetallic Minerals	14.7	19.2%
Food Or Kindred Products	2.5	3.3%
Chemicals Or Allied Products	1.0	1.4%
Rubber Or Miscellaneous Plastics	0.8	1.1%
Fabricated Metal Products	0.7	0.9%
Printed Matter	0.7	0.9%
Primary Metal Products	0.4	0.5%
Total Tons	**76.3**	**98.0%**

Source: Global Insight TRANSEARCH 2008 Release

Table 24: Top Ten Commodities Passing Through Massachusetts All Modes (Millions of Tons), 2007

Commodity	Total Tons	% Share
Food Or Kindred Products	8.5	15.9%
Pulp, Paper Or Allied Products	8.3	15.6%
Chemicals Or Allied Products	7.6	14.3%
Secondary Traffic (Truck Distribution)	3.9	7.3%
Petroleum Or Coal Products	3.9	7.2%
Clay, Concrete, Glass Or Stone	3.3	6.2%
Primary Metal Products	2.5	4.6%
Lumber Or Wood Products	2.2	4.1%
Nonmetallic Minerals	1.7	3.2%
Coal	1.5	2.9%
Total Tons	**53.4**	**81.3%**

Source: Global Insight TRANSEARCH 2008 Release

3.3.2.2 Freight Flows by Value

The top commodities by value are fairly different from the largest commodities by tonnage. Electronics and machinery account for nearly 28 percent of all value, followed by what is categorized as mixed freight or unknown freight[16] at 11.8 percent and farm products, food and beverages at 10.7 percent. These are followed closely by textiles and leather (8.6 percent) and chemicals-pharmaceuticals-fertilizer (7.6 percent).

Commodities with the largest share by value moved within Massachusetts have remained relatively consistent over the past five years, but growth rates do vary among the commodities as seen in Table 25. The greatest growth in value of commodities traveling in Massachusetts has been in coal. The value of coal moved was $29 million in 2002 and $46 million in 2007. Additional large growth occurred with precision instruments, minerals and ores, and stone and sand.

The top commodities by value moved outbound from Massachusetts were electronics and machinery, accounting for 35.5 percent of value or $54.35 billion, and textiles and leather, accounting for 12.6 percent or $19.49 billion. Of the outbound commodities, most of the shipments are to the rest of New England (18 percent), the Mid-Atlantic (26 percent), or the Midwest (13 percent) with an additional 18 percent moving to the Rockies/West.

The top commodities moved inbound to Massachusetts were also electronics and machinery, accounting for $31.82 billion or 24.2 percent of inbound value, and farm products, food, and beverages accounting for $18.69 billion or 14.2 percent of value. Of these inbound commodities, nearly half arrive from the rest of New England or the Mid-Atlantic regions while 19 percent come from the Midwest/Plains and 17 percent come from the southern US.

The value of Massachusetts outbound shipments is greater than the value of inbound shipments. The more valuable exports, such as computers and electronics, textiles/leather, and chemical products tend to make up a smaller share of tonnage and higher share of value since they generally weigh less.

[16] Mixed freight includes food for grocery and convenience stores, restaurant supplies, office supplies, hardware and pluming supplies, and other miscellaneous shipments. Unknown freight is that where the specific commodity is unknown.

Table 25: Value of Commodities Transported within Massachusetts ($Millions), 2002 and 2007

	VALUE		GROWTH RATE
	2002	2007	2002-2007
Electronics/Machinery	$96,194	$107,498	2.2%
Mixed Freight/Unknown	$42,610	$45,678	1.4%
Farm Prods/food/beverages	$38,510	$41,351	1.4%
Textiles/leather	$33,048	$33,135	0.1%
Chemicals/Pharmaceuticals/Fertilizer	$27,343	$29,298	1.4%
Precision Instruments	$16,710	$20,532	4.2%
Paper	$18,574	$19,439	0.9%
Miscellaneous Mfg Products	$16,591	$16,931	0.4%
Transportation Equipment	$14,512	$16,090	2.1%
Base Metals	$13,676	$14,717	1.5%
Plastics/Rubber	$12,280	$12,985	1.1%
Wood/furniture	$11,092	$11,934	1.5%
Gasoline, Fuel	$7,409	$7,485	0.2%
Waste/Scrap	$4,866	$5,135	1.1%
Minerals and Ores	$2,777	$3,273	3.3%
Stone and Sand	$395	$465	3.3%
Coal	$29	$46	9.7%
Total	**$356,617**	**$385,992**	**1.6%**

Source: FAF^2 2007 Provisional Data

3.3.2.3 Detailed Shipping Patterns of Top Commodities

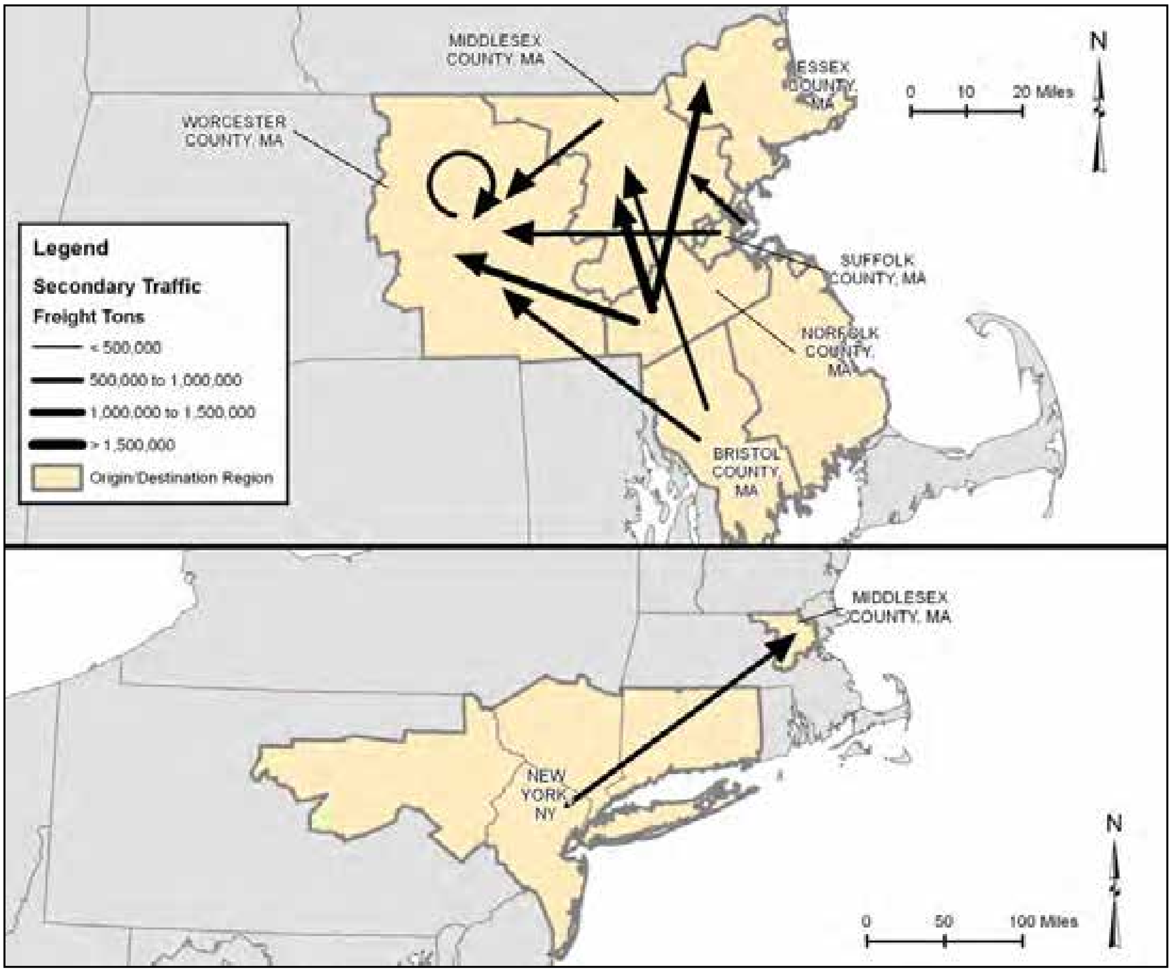
An analysis of the shipping patterns of the top commodities by tonnage in Massachusetts illustrates the key origins and destinations of major commodities. This provides an understanding of the major corridors, routes, and shipping distances of the largest trade flows. Through this analysis, it is possible to consider which commodities and which types of trade flows have the potential to be shipped by alternative modes. For example, long-distance commodity flows that travel through the Commonwealth could be candidates for rail or water transportation in addition to truck. In contrast, shorter distance, internal commodity flows focused on local/regional distribution may by necessity need to be moved by truck.

As described above, some of the top commodity movements in Massachusetts include:

- Secondary truck traffic;
- Pulp, paper and allied products;
- Petroleum and coal;
- Nonmetallic minerals; and
- Food or kindred products.

Figure 27 through Figure 31 show these five major commodities with arrows depicting the top ten trade flows by origin and destination. The arrows vary in width based on the size of the trade flow as indicated in each legend, and the curved arrows represent trade flows internal to a county.

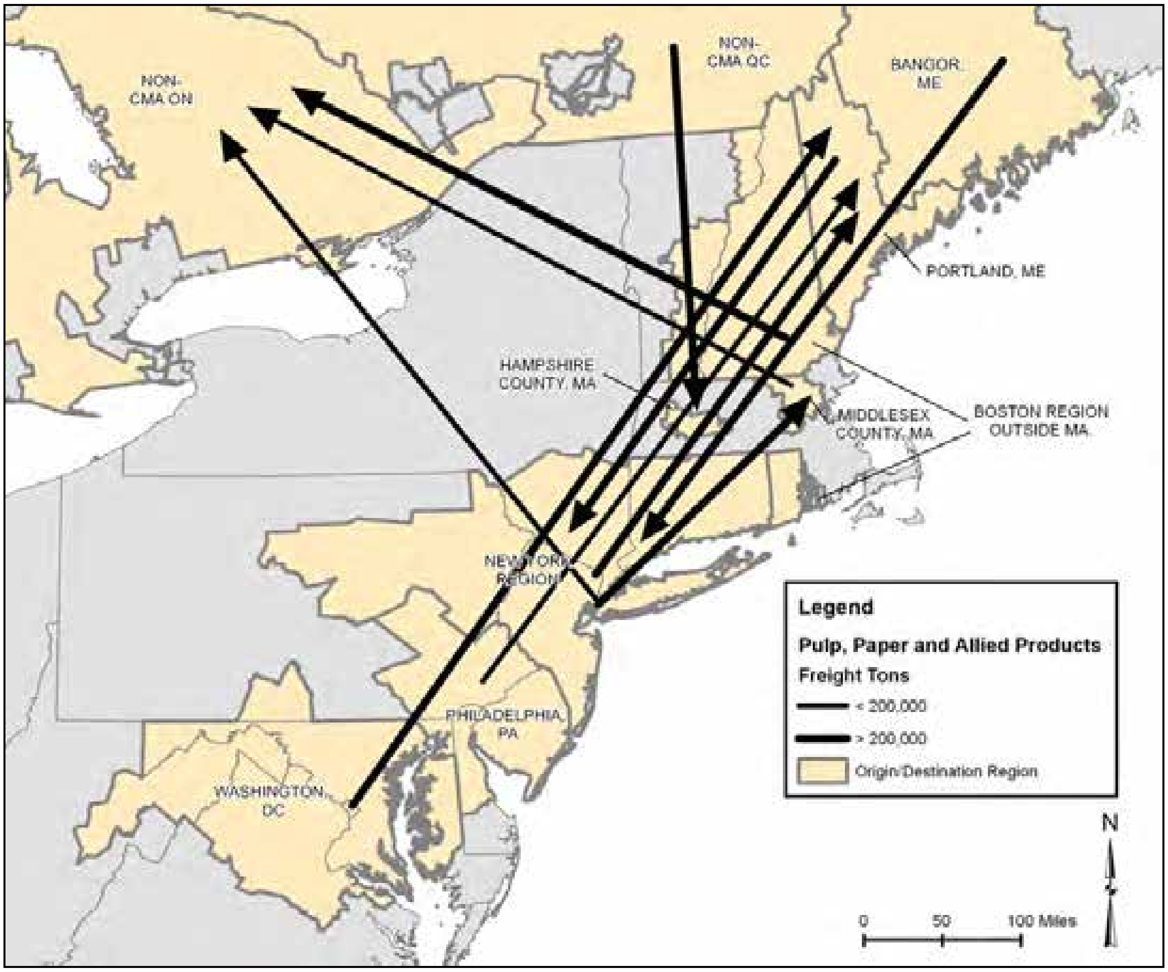
Figure 27: Top Ten Secondary Traffic Movements by Origin and Destination Region



Source: Global Insight TRANSEARCH 2008 Release

As anticipated, most of the secondary truck traffic moves short distances within Massachusetts as it largely captures distribution related activity, with the exception being flows from the New York market to the greater Boston area. The largest volumes of secondary traffic are from Norfolk County to Middlesex, Essex and Worcester counties. This coincides with the location of numerous distribution facilities in the southeast region of the Commonwealth.

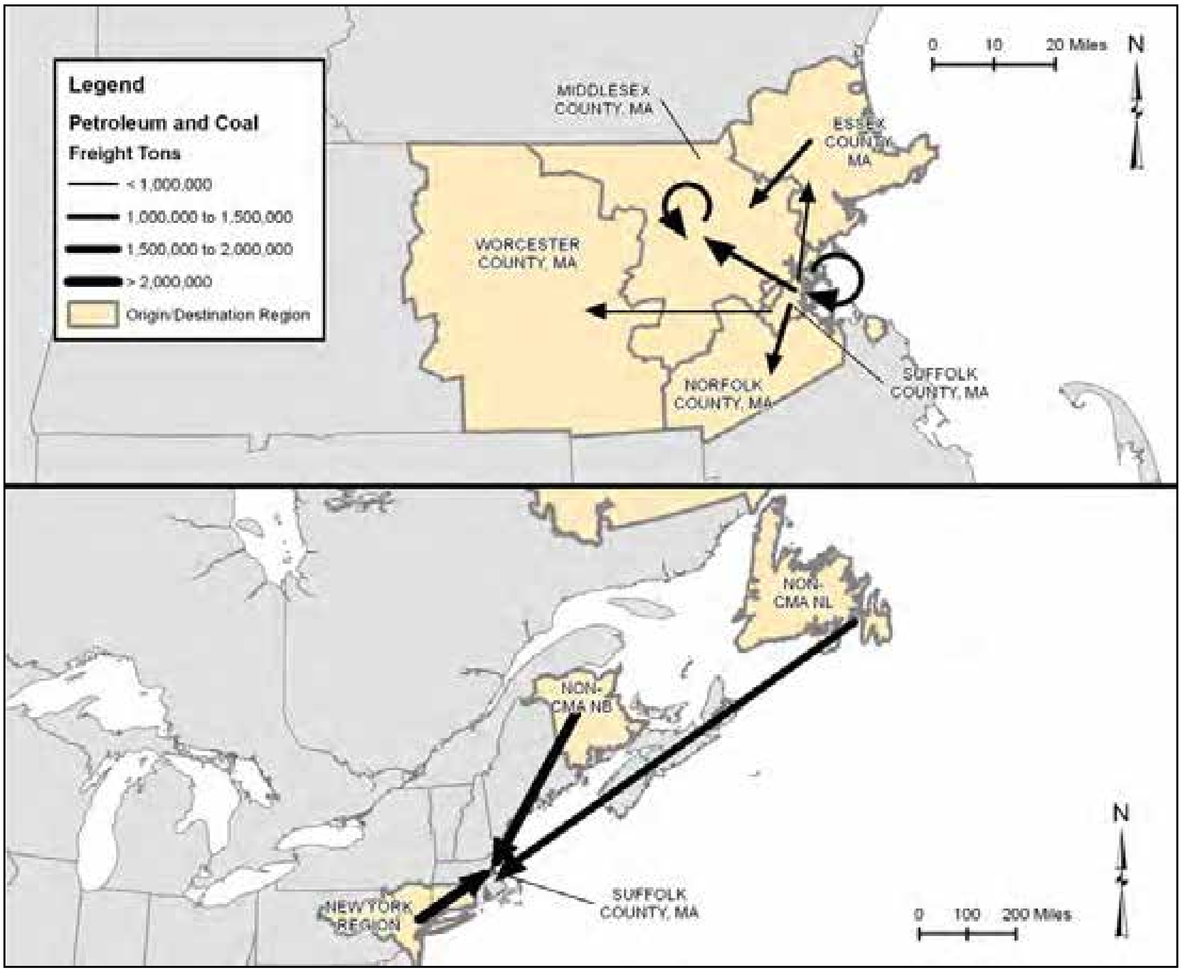
Figure 28: Top Pulp, Paper and Allied Products Movements, 2007



Source: Global Insight TRANSEARCH 2008 Release

In stark contrast, most of the top shipping patterns of the pulp and paper commodity are longer distance shipments that travel through Massachusetts without an origin or destination. Many of these top flows have an origin or destination in northern New England, reflecting the traditionally large paper industry in Maine, in particular. This commodity, which currently uses a variety of modes, could be a candidate for shipping more products via rail or water depending on infrastructure improvements, shipping costs, and reliability.

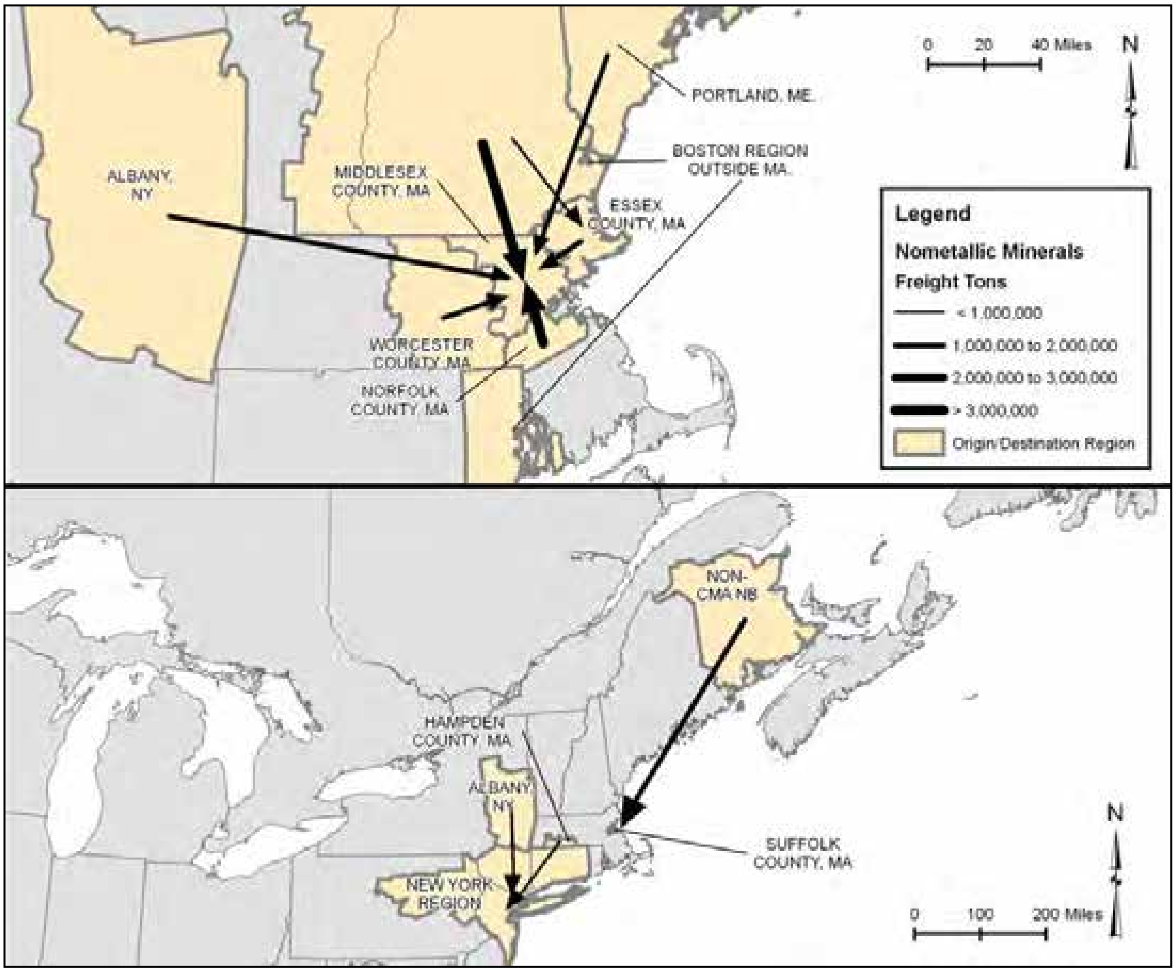
Figure 29: Top Ten Petroleum and Coal Movements, 2007



Source: Global Insight TRANSEARCH 2008 Release

The shipping pattern of petroleum and coal products is dominated by two kinds of movements: a) very large inbound volumes from the New York and Canadian markets; and b) internal distribution within the greater Boston area. Consequently, most inbound shipments of petroleum and coal products are by water, rail or truck to the Boston area, and then transported by truck to meet local demand.

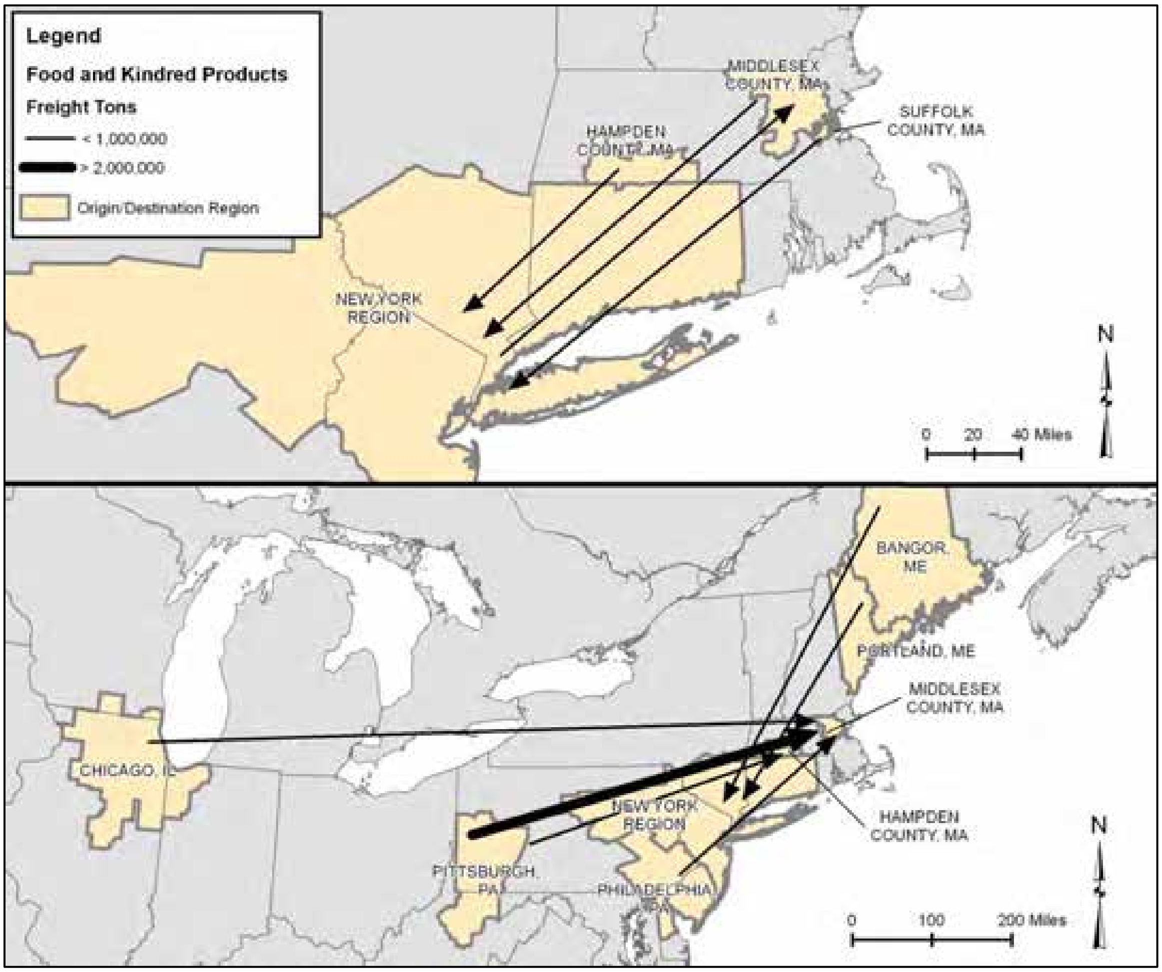
Figure 30: Top Ten Nonmetallic Mineral Movements, 2007



Source: Global Insight TRANSEARCH 2008 Release

The shipping patterns of the top ten nonmetallic mineral movements are a bit more varied as many of the top flows are local or regional shipments destined for Middlesex County (the largest single consumer market in the Commonwealth), along with some longer-distance inbound, outbound and through trips connecting with the Canadian Maritimes and the New York region.

Figure 31: Top Ten Food and Kindred Products Movements, 2007



Source: Global Insight TRANSEARCH 2008 Release

The food and related products commodity flows are highlighted by: a) large inbound volumes from Pennsylvania and the midwest US; b) relatively balanced trade between Boston and Springfield markets and the New York region; and c) longer-distance through trips from Maine to the New York region (passing through Massachusetts). The relatively large volume of longer-distance shipments of food products (also a major inbound commodity at the Port of Boston) suggests a dynamic commodity in terms of multi-modal transportation options.

3.3.3 MODAL FREIGHT FLOW ASSESSMENT

Fully understanding freight movements is necessary when evaluating trade flows by the modes of truck, rail, water, and air. In addition to the TRANSEARCH and FAF data presented above, this analysis includes mode-specific data from the WISER Trade database for imports and exports, as well as Massport data to most accurately capture the major air and water cargo movements through Logan Airport and the Port of Boston.

3.3.3.1 Truck Movements

Trucking is the most dynamic and flexible mode of transportation, either hauling goods start to finish or connecting multiple modes together. Trucks are often responsible for connecting freight operations to and from airports, rail intermodal facilities, distribution centers, and seaports. Goods moved by truck account for 86 percent of all freight movements in Massachusetts, and over 239 million tons (Table 26). The largest share of this tonnage, 38.8 million or 16.2 percent, is due to secondary traffic. Nonmetallic minerals, petroleum or coal products, and chemicals or allied products, accounting for 13.7, 12.8, and 10.8 percent respectively, are large contributors to the truck freight movements totaling 37 percent of all truck tonnage in the Commonwealth. Food or kindred products account for 12.7 percent of tonnage, which is the fourth largest share.

Table 26: Top Ten Truck Movements (Millions of Tons), 2007

Commodity	Truck Tons	% Share
Secondary Truck Traffic	38.8	16.2%
Nonmetallic Minerals	32.8	13.7%
Petroleum or Coal Products	30.6	12.8%
Food or Kindred Products	30.5	12.7%
Chemicals or Allied Products	25.9	10.8%
Clay, Concrete, Glass or Stone	25.6	10.7%
Pulp, Paper or Allied Products	11.4	4.8%
Primary Metal Products	8.7	3.6%
Lumber or Wood Products	6.4	2.7%
Fabricated Metal Products	5.5	2.3%
Total Tons	**239.3**	**90.4%**

Source: Global Insight TRANSEARCH 2008 Release

Table 27 illustrates the top Origin-Destination pairs for truck freight in 2007. The largest share of truck freight came from the New York region into Massachusetts. This was followed by freight originating in the regions surrounding the Boston metropolitan area (Providence, Manchester) traveling inbound to Massachusetts. Lastly there was a large amount of truck traffic outbound from Massachusetts to the New York region.

Table 27: Top Ten Truck Origin-Destination Pairs (Millions of Tons), 2007

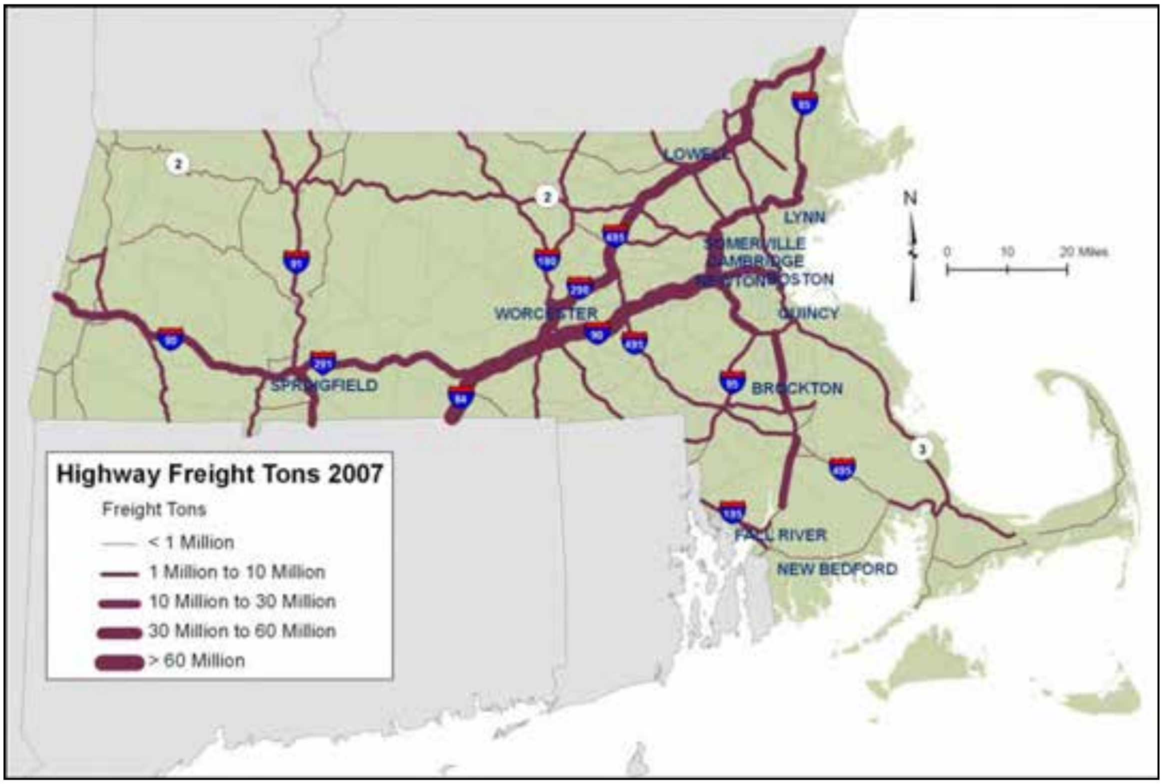
Origin Region	Destination Region	Truck Tons
New York NY	Massachusetts	12.6
Non-MA Boston Region*	Massachusetts	11.5
Massachusetts	New York, NY	10.7
Massachusetts	Non-MA Boston Region*	6.4
Pittsburgh PA	Massachusetts	4.4
Philadelphia PA	Massachusetts	4.3
Albany NY	Massachusetts	3.2
Portland ME	Massachusetts	2.8
Cleveland OH	Massachusetts	2.8
Chicago IL	Massachusetts	2.7

Source: Global Insight TRANSEARCH 2008 Release
*Note: Non-MA Boston Region includes areas in New Hampshire and Rhode Island that are part of the Boston metropolitan region.

The following figures demonstrate the movement of freight tonnage along the major highway routes in Massachusetts, with thicker lines representing large volumes of freight truck activity.

Figure 32 maps the movement of all highway freight tons throughout Massachusetts, regardless of direction. Note that the scale on the total highway freight tons is such that the highest value on the scale is tonnage “greater than 50 million.” The highest level of tonnage was 106.3 million tons on I-84 and segments of I-90. Tonnage is heaviest in the eastern part of the Commonwealth with large volumes on I-495, I-290, I-95 north of I-90, and on I-90/I-84, which connects eastern Massachusetts with the New York City region via Hartford, Connecticut.

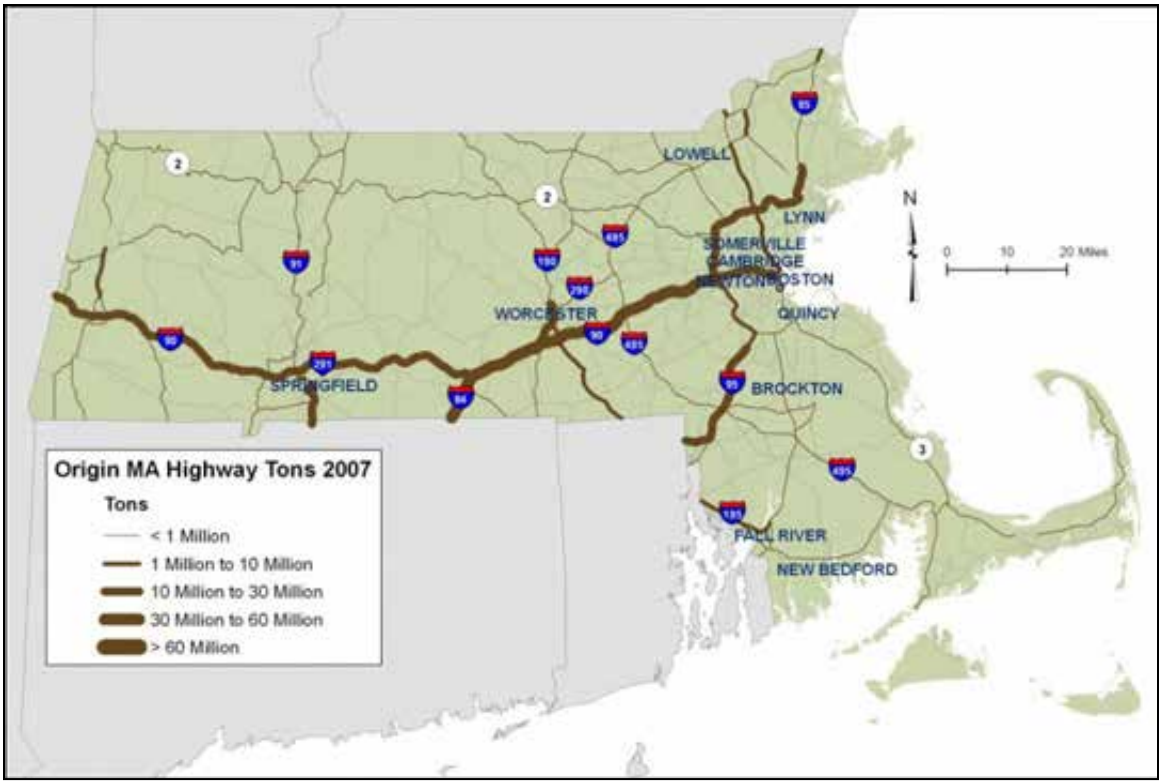
Figure 32: Massachusetts Total Truck Freight Tons by Highway Route, 2007



Source: Global Insight TRANSEARCH 2008 Release

The 2007 volume of outbound highway tonnage from Massachusetts to external destinations is provided in Figure 33. Tonnage is heaviest on I-95, the I-90/I-84 corridor, and I-91 from Springfield south into Connecticut. The highest tonnage value is 13.9 million.

Figure 33: Massachusetts Outbound Truck Freight Tons by Highway Route, 2007



Source: Global Insight TRANSEARCH 2008 Release

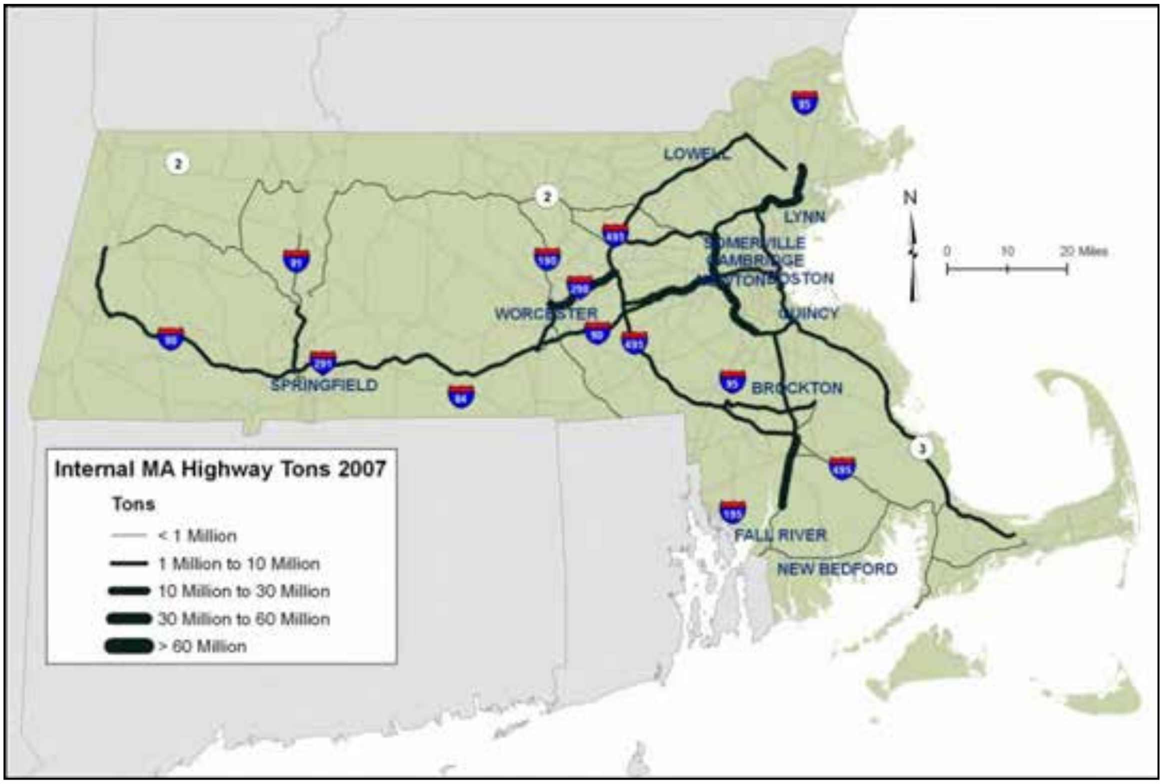
The inbound tonnage to Massachusetts by highway route is shown in Figure 34. As expected, the heaviest segment for inbound shipments is larger than the heaviest segment in the outbound tonnage since Massachusetts imports more tonnage of freight than it exports. The highest tonnage value is 49.6 million on I-90 between I-84 and I-290 with other highway segments between 36 and 43 million tons on I-90 and I-95. After these ranges, the next highest value is 12 million tons. As expected based on Massachusetts' population distribution, most of the inbound freight is destined to the eastern portion of the Commonwealth, with the heaviest volumes on I-84/I-90 and I-95 North of Boston.

Figure 34: Massachusetts Inbound Truck Freight Tons by Highway Route, 2007

Source: Global Insight TRANSEARCH 2008 Release

Figure 35 shows internal truck freight flows that have both an origin and a destination within the Commonwealth. Much of the freight is concentrated in the central Massachusetts, greater Boston, and southeastern parts of the Commonwealth, with other concentrations near Springfield and the Pioneer Valley, as well as the connection between I-90 at Lee and Pittsfield in the Berkshires.

Figure 35: Massachusetts Internal Truck Freight Tons by Highway Route, 2007



Source: Global Insight TRANSEARCH 2008 Release

The volume of through tonnage with both origins and destinations outside of Massachusetts that use the Massachusetts highway system is shown in Figure 36. There are high truck volumes on Interstates 495, 290, 90 and 84, which collectively form a link between the New York City region and Maine. Additionally, there are fairly heavy volumes on I-91 moving north-south between Vermont and Connecticut and on I-90, connecting to upstate New York and longer-distance markets. Very little of the through traffic uses routes in the northwest or southeast portions of the Commonwealth, as these are less convenient access routes to external destinations.

Figure 36: Massachusetts Through Truck Freight Tons by Highway Route, 2007

Source: Global Insight TRANSEARCH 2008 Release

3.3.3.2 Rail Movements

Rail traditionally ships heavier bulk commodities that are hauled longer distances and are generally not as time sensitive as air or truck movements, although hitting delivery windows is still critical. The primary advantage of shipping freight via rail is the hauling capacity and relatively low costs of rail as it is one of the most efficient modes of transportation. Goods moved by rail account for the 6.5 percent of all freight movements in Massachusetts, including through traffic. As shown in Table 28, the rail system in Massachusetts moves primarily pulp/paper products, mixed shipments, chemicals, and waste/scrap commodities.

Table 28: Top Ten Rail Commodities in Massachusetts (Thousands of Tons), 2007

Commodity	Rail Tons	% Share
Pulp, Paper Or Allied Products	2,773	15.5%
Miscellaneous Mixed Shipments	2,148	12.0%
Chemicals Or Allied Products	2,108	11.7%
Waste Or Scrap Materials	2,049	11.4%
Food Or Kindred Products	1,800	10.0%
Clay, Concrete, Glass Or Stone	1,307	7.3%
Coal	1,301	7.3%
Lumber Or Wood Products	1,017	5.7%
Farm Products	958	5.3%
Transportation Equipment	705	3.9%
Total Tons	**17,942**	**90.1%**

Source: Global Insight TRANSEARCH 2008 Release

Table 29 indicates that the Chicago region was the top freight rail origin-destination for Massachusetts in 2007. This is attributed to freight rail intermodal and transloading operations of national goods movement in the Chicago area. The remaining top ten origin-destination pairs are all inbound freight shipments to the Commonwealth.

Table 29: Top Ten Rail Origin-Destination Pairs (Thousands of Tons), 2007

Origin Region	Destination Region	Rail Tons
Chicago IL	Massachusetts	2,155
Massachusetts	Chicago IL	1,074
Non-Metropolitan QC	Massachusetts	851
Non-MA Boston Region	Massachusetts	573
Toledo OH	Massachusetts	307
Cleveland OH	Massachusetts	268
St. Louis MO	Massachusetts	255
Non-Metropolitan ON	Massachusetts	252
Indianapolis IN	Massachusetts	240
Albany NY	Massachusetts	239

Source: Global Insight TRANSEARCH 2008 Release

Figure 37 portrays the movement of all rail tons, regardless of direction, on Massachusetts rail lines. Although rail traditionally carries heavier bulk commodities, the most rail tonnage on any line segment within Massachusetts is approximately 10.7 million tons. Interestingly, the heaviest level of rail traffic is in the western part of the Commonwealth, between the Albany, New York area and Springfield. Other large freight rail corridors are along the northern part of Massachusetts traveling east-west and connecting to New York and Maine, as well as connecting north-south rail corridors. This is quite different from the way truck freight travels in the Commonwealth; much of the freight traveling by rail is inbound from the western connections and rail destinations for this traffic are located in the western part of Massachusetts. Rail volumes decrease as the rail lines approach Boston. This is based on factors such as the intermodal rail facilities in West Springfield and Worcester where rail goods are transferred to truck for final deliveries, and the current double-stack clearance constraint.

Figure 37: Massachusetts Total Rail Freight Tons, 2007

Source: Global Insight TRANSEARCH 2008 Release

3.3.3.3 Water Movements

The major Massachusetts ports of Boston, Salem, Gloucester, New Bedford, and Fall River ship and receive a variety of commodities both domestically and internationally. Like other modes, the total inbound tonnage is greater than the total outbound tonnage. Goods moved by water account for 4.9 percent of all freight movements in Massachusetts. The majority, 66.1 percent (9.2 million tons), of water movements by tonnage are petroleum or coal products. This is followed by waste or scrap materials, and nonmetallic minerals, accounting for 12.1 percent and 11.0 percent respectively. Together, these three commodities account for nearly 90 percent of all water traffic in the Commonwealth of Massachusetts by weight. Table 30 shows the top ten water commodities for all ports in Massachusetts.

Table 30: Top Ten Water Movements in Massachusetts (Thousands of Tons), 2007

Commodity	Water Tons	% Share
Petroleum Or Coal Products	9,162	66.1%
Waste Or Scrap Materials	1,675	12.1%
Nonmetallic Minerals	1,524	11.0%
Chemicals Or Allied Products	679	4.9%
Coal	523	3.8%
Clay, Concrete, Glass Or Stone	183	1.3%
Miscellaneous Freight Shipments	77	0.6%
Transportation Equipment	16	0.1%
Food Or Kindred Products	7	0.1%
Lumber Or Wood Products	6	0.0%
Total Tons	**13,857**	**99.97%**

Source: Global Insight TRANSEARCH 2008 Release

The Port Import Export Reporting Service (PIERS),[17] World Institute for Strategic Economic Research (WISER),[18] and Port of Boston data provide more detailed information on commodity shipments, value, and trading partners at the port level. Table 31 and Table 32 show the top inbound and outbound shipments from the Conley terminal in Boston from July 2007 through June 2008 in Twenty Foot Equivalent Units (TEUs).[19] Fifty percent of these TEU volumes is represented by a variety of commodities included in the other category. This reflects the wide variety of largely consumer goods traveling by container. The largest single inbound commodity in TEUs is furniture, followed by frozen fish, beer and ale, and still wines. Furniture accounts for approximately 9.4 percent of the TEUs, and the top food products combined account for approximately 18.6 percent. Outbound commodities are less diverse, with paper and paperboard accounting for more than one third of all containers, automobiles accounting for 11.5 percent and metal scrap accounting for 7.7 percent.

Table 31: Top Waterborne Inbound Commodities to Conley Terminal (Thousands of TEUs), July 2007-June 2008

Commodity	TEUs	% of Total
Other	50.0	53.8%
Furniture	8.8	9.4%
Frozen Fish	6.8	7.3%
Beer & Ale	6.0	6.4%
Still Wines	4.5	4.9%
Miscellaneous General Cargo	3.4	3.7%
Toys	3.3	3.5%
Footwear	3.0	3.2%
Miscellaneous Plastic Products	2.6	2.8%
Apparels	2.5	2.7%
Spirits and Cordials	2.1	2.2%
Total Tons	**92.9**	

Source: PIERS data for Conley Terminal

17 A comprehensive port cargo database.
18 An international trade database.
19 A single TEU represents one standardized twenty foot long shipping container.

Table 32: Top Waterborne Outbound Commodities Conley Terminal (Thousands of TEUs), July 2007-June 2008

Commodity	TEUs	% of Total
Paper & Paperboard, including waste	21.2	34.4%
Automobiles	7.1	11.5%
Mixed Metal Scrap	4.8	7.7%
Hides, Skins and Furs	3.2	5.2%
Logs and Lumber	3.0	4.8%
Foam Waste and Scrap	1.9	3.0%
Miscellaneous General Cargo	1.7	2.7%
Miscellaneous Plastic Film and Sheet	1.3	2.1%
Fish	1.3	2.1%
Household Goods	1.2	1.9%
Other	15.1	24.5%
Total Tons	**61.7**	

Source: PIERS data for Conley Terminal

A breakdown of bulk cargo originating and terminating via the Port of Boston is found in Table 33 highlighting the importance of petroleum products shipped by water as well as liquefied natural gas.

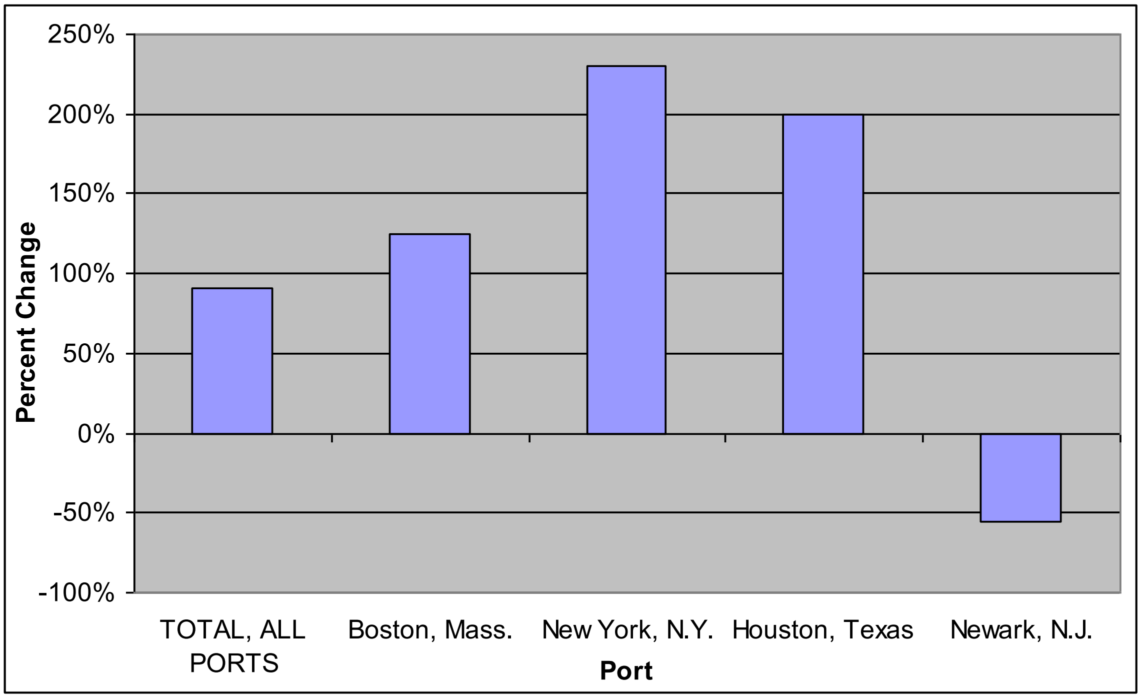
Table 33: Port of Boston Commodities (Thousands of Metric Tons), 2007

	2007	% Share
Bulk Cargo Terminating		
Petroleum Products	7,679	58.2%
Liquefied Natural Gas	3,155	23.9%
Salt	715	5.4%
Cement (includes barge volume)	258	2.0%
Gypsum	159	1.2%
Automobiles (Autoport)	12	0.1%
Other	1,224	9.3%
Sub-total Bulk Cargo Terminating	13,202	
Bulk Cargo Originating		
Scrap Metal	540	93.8%
Other	35	6.2%
Sub-total Bulk Cargo Originating	575	
Total Bulk Cargo	**13,777**	

Source: Massport

It is important to note that while Massachusetts does have five major ports, not all water freight originating in Massachusetts will leave via a Massachusetts port. For example, intermodal connections allow for goods produced in Massachusetts to be transported via truck or rail to the Port of New York or New Jersey. According to the WISER data for waterborne commerce, the amount of Massachusetts freight exiting from the Port of Boston is three and a half times greater than the amount of Massachusetts freight exiting from the Port of New York. In addition, between 1997 and 2007 the amount of freight by vessel weight leaving the Port of Boston has doubled. Figure 38 indicates the *growth* of tonnage of Massachusetts outbound shipments in the past ten years. New York has shown the largest percentage growth at more than 225 percent, followed by Boston and Houston, TX at 200 percent and 125 percent respectively. Newark, NJ, which is one of the top ports of exit for Massachusetts goods, is the only port to experience negative growth, decreasing by more than 50 percent over the period.

Figure 38: Massachusetts Marine Outbound Shipment Growth by Weight, 1997-2007



Source: WISERTrade Data

Between 2003 and 2007 half of the Massachusetts ports experienced growth and half experienced decline in terms of outbound freight values as shown in Table 34. The Ports of Gloucester, Provincetown, and Boston all experienced substantial growth of at least 100 percent, while Salem grew slightly. The Ports of Fall River, New Bedford and Plymouth all experienced a decline in terms of value between 71 and 94 percent.

Table 34: Value of Outbound Shipments from Massachusetts Maritime Ports ($Thousands), 2003 and 2007

Port	2003	2007	Change 2003-2007	% Change 2003-2007
Boston	791,948	1,592,176	800,228	101%
Salem	9,500	10,046	547	6%
Gloucester	432	2,062	1,631	378%
Fall River	3,084	905	(2,179)	-71%
New Bedford	5,461	553	(4,907)	-90%
Provincetown	94	262	168	178%
Plymouth	456	27	(429)	-94%
Total	**811,082**	**1,606,137**	**795,055**	**98%**

Source: WISERTrade Data

Massachusetts experienced overall growth in value of inbound shipments, while approximately half of the ports experienced a decline as shown in Table 35. Provincetown, Boston, Fall River and Salem all experienced growth, although the growth in inbound value was smaller than outbound. Lawrence, New Bedford, Plymouth, and Gloucester all saw declines in their outbound value over the period as smaller ports are challenged to stay competitive in today's freight shipping environment that favors larger ships and larger ports.

Table 35: Value of Inbound Shipments to Massachusetts Maritime Ports ($Thousands), 2003 and 2007

Description	2003	2007	Change 2003-2007	% Change 2003-2007
Boston	5,073,171	8,784,979	3,711,808	73%
Fall River	71,261	119,531	48,271	68%
Salem	30,095	36,344	6,249	21%
Plymouth	103,719	26,568	(77,151)	-74%
New Bedford	65,290	6,274	(59,016)	-90%
Lawrence	43,643	2,941	(40,702)	-93%
Gloucester	687	622	(64)	-9%
Provincetown	18	32	14	79%
Total	**5,387,883**	**8,977,292**	**3,589,409**	**67%**

Source: WISERTrade Data

Table 36 shows that the majority of the top water tonnage origin-destination pairs represent inbound freight. Note these top origin and destination pairs only include domestic and NAFTA trading partners.

Table 36: Top Ten Water Origin-Destination Pairs (Thousands of Tons), 2007

Origin Region	Destination Region	Water Tons
Non-Metropolitan NB	Massachusetts	3,737
New York NY	Massachusetts	3,582
Non- Metropolitan NL	Massachusetts	1,629
Philadelphia PA	Massachusetts	744
Washington DC	Massachusetts	567
Non- Metropolitan QC	Massachusetts	439
Non- Metropolitan NS	Massachusetts	356
Norfolk VA	Massachusetts	322
Massachusetts	New York NY	298
St. John's NL	Massachusetts	220

Source: Global Insight TRANSEARCH 2008 Release

3.3.3.4 Air Movements

Goods moved by air account for less than 1 percent of all freight movements in Massachusetts on a tonnage basis but over 5 percent by value. Air cargo accounts for a small percent of tonnage because goods that are moved by air tend to be lighter than those hauled by surface transportation. Chemicals or allied products account for the majority of tonnage at 24.5 percent, followed by mail or contract traffic at 15.9 percent (see Table 37) for the top ten air freight commodities by tonnage.

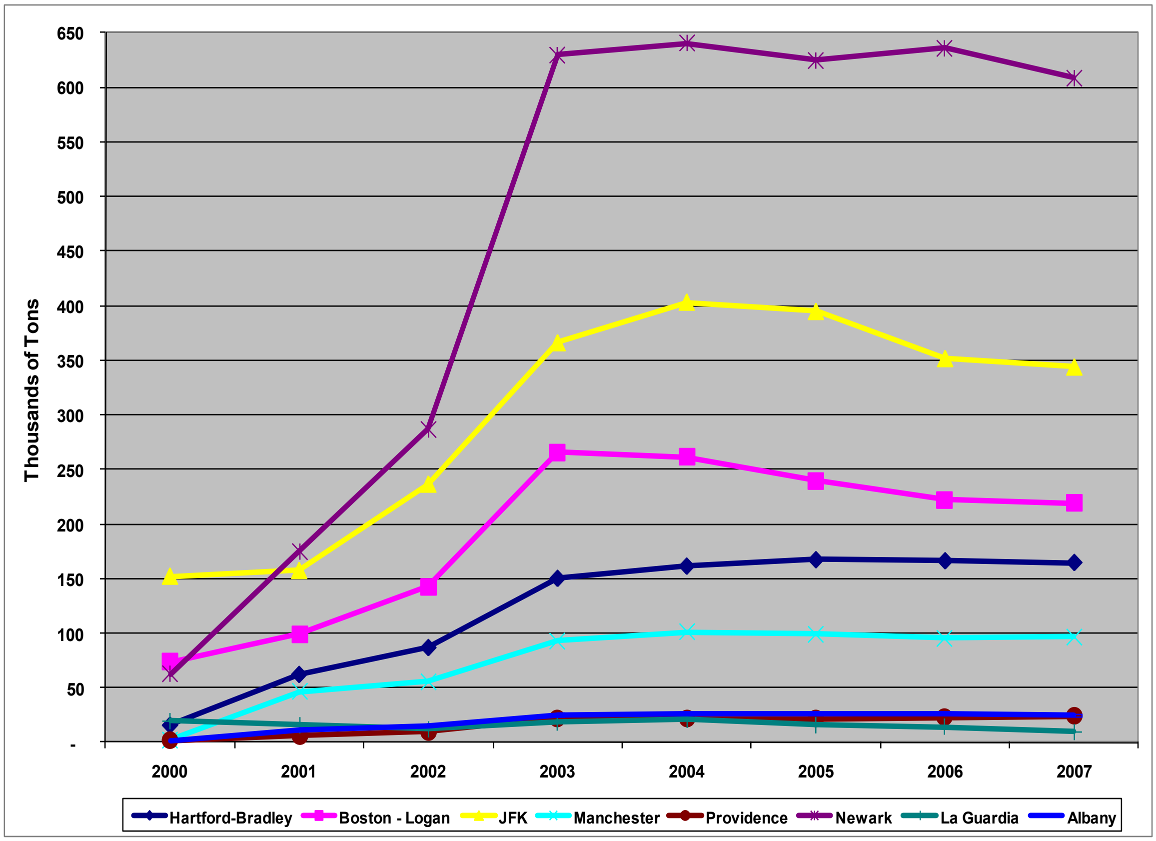
Table 37: Top Ten Air Movements in Massachusetts (Thousands), 2007

Commodity	Air Tons	% Share
Chemicals Or Allied Products	78	24.5%
Mail Or Contract Traffic	51	15.9%
Pulp, Paper Or Allied Products	31	9.8%
Machinery	23	7.3%
Transportation Equipment	20	6.1%
Electrical Equipment	19	5.9%
Fresh Fish Or Marine Products	15	4.6%
Instruments, Photo Equip, Optical Equip	14	4.3%
Clay, Concrete, Glass Or Stone	13	4.0%
Fabricated Metal Products	8	2.4%
Total Tons	**319**	**84.9%**

Source: Global Insight TRANSEARCH 2008 Release

Boston's Logan Airport moved 218,965 tons in 2007, and has the most domestic tonnage for all of New England, followed by Bradley Airport's (Hartford) 164,667 tons as presented in Figure 39). Regionally, only Newark and JFK carry more total domestic freight tonnage than Logan Airport. Since 2005, only Providence has shown positive growth in total domestic freight tonnage, while growth for Manchester, Newark, and Albany airports remained relatively flat.

Figure 39: Total Air Cargo Tonnage by Airport in Northeast Region, 2003-2007



Source: BTS Transtats T-100 Domestic Market (US Carriers)

Logan airport's air freight is an almost perfect 50-50 split for inbound and outbound tonnage, which is similar to the patterns at the NY and NJ airports. Table 38 below shows the air cargo inbound and outbound volumes by millions of pounds for 2000, 2003 and 2007 demonstrating the balanced trade.

Table 38: Logan Air Cargo (Millions of Pounds), 2000, 2003, 2007

	2000	2003	2007
Inbound	533	419	333
Outbound	514	381	325

Source: Massport

The majority of domestic and international air freight leaving Massachusetts, in terms of dollar value, exits via Logan Airport. Of the export goods produced in Massachusetts, Logan Airport ships more international freight by value than any other New England Airport, and was just ahead of JFK in New York. In contrast to the relatively flat air tonnage trends, the value of international air exports more than doubled from 1997 to 2007 (not accounting for inflation). New York's JFK Airport ships the second largest dollar amount of international air freight originating from Massachusetts businesses, and was the largest airport for Massachusetts export shipments by air as recently as 1997. In 2007, over $6.8 billion dollars of domestic and international air freight from Massachusetts flew out of New York's JFK Airport.[20] As the total air freight tonnage in Massachusetts for 2007 was 318,894, Table 39 shows the total value of air freight at $8.8 billion dollars, confirming air freight has a very high value to weight ratio.

Table 39: Value of Massachusetts Air Outbound and Inbound Shipments ($Millions), 2007

Description	Inbound	Outbound
Logan Airport - Boston	$ 5,946	$ 8,794
Worcester	$ 11	$ 21
Springfield	$ 4	$ 2
Total	**$ 5,961**	**$ 8,816**

Source: WISERTrade Data

The latest forecasts of air cargo for Logan Airport as provided by Massport are shown in Table 40. Highlights include:

- Annual air freight will grow from 287,000 tons in 2007 to between 319,000 and 391,000 in 2025.
- Integrated express traffic will grow at an average of 1 percent per year, and Logan's share of express traffic will decline from 63 percent to 60 percent by 2025.
- International passenger aircraft belly freight is the fastest growing segment of the Logan cargo market and will increase by 15,000-37,000 tons by 2025.
- Air freight is critical to securing new international services at Logan because of its significant contribution to airline profitability.
- The average annual growth rate for air freight between 2007 and 2025 is likely to be between 1.1 percent and 1.3 percent.

Table 40: Logan Air Cargo Tonnage and Share of Cargo by Type: Domestic and International

	Percent of Cargo			Tons (000's)
Years	Domestic Belly	International Belly	Express	Total
2007	17%	20%	63%	287
2015	16%	22%	62%	313
2025	15%	24%	61%	365

Source: Massport

3.3.4 COUNTY AND REGIONAL ANALYSIS OF FREIGHT FLOWS

County and regional freight flow analysis provides insight on how freight volumes and commodities vary within the Commonwealth. Table 41 presents the top five commodity flows by county for outbound, inbound, and internal shipments, with Middlesex County by far the largest in terms of inbound volumes and Worcester County just ahead of Middlesex, Suffolk, and Hampden counties for top outbound flows. Appendix 3 provides a detailed county-by-county assessment of the top freight shipping patterns in terms of key markets for origins, destinations, and trading partners.

[20] WISERTrade Data

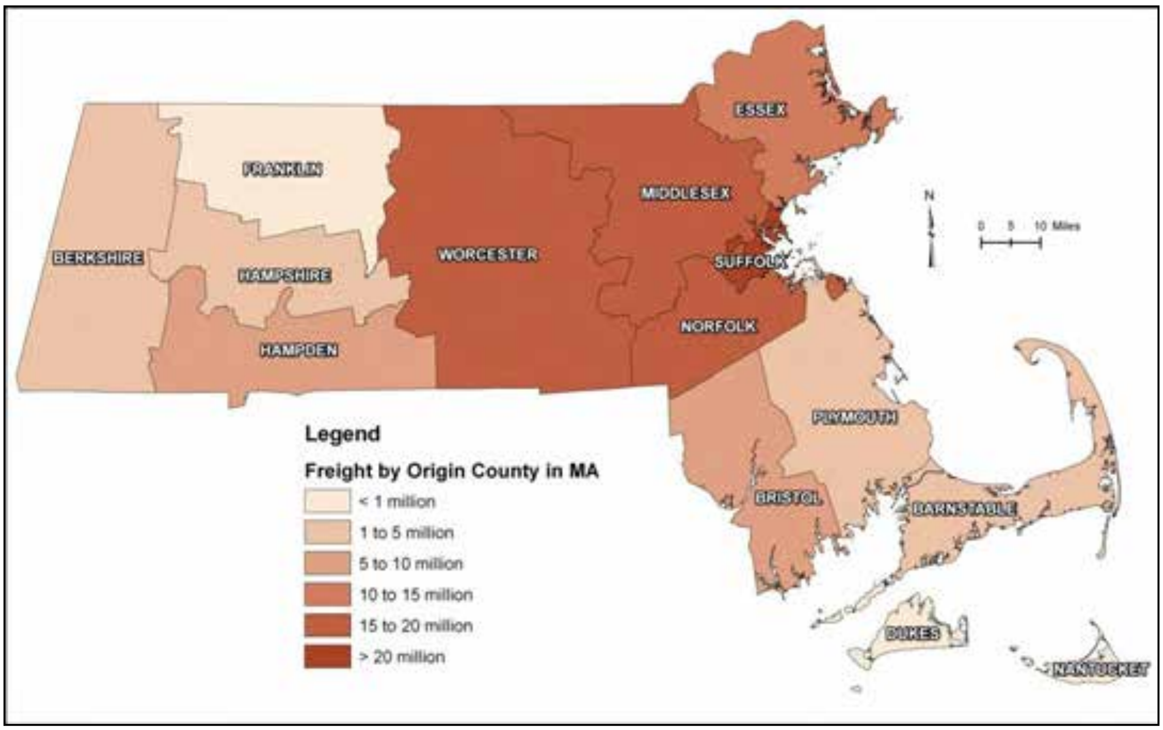
Table 41: Top Freight Movements by County and Direction (Millions of Tons)

Outbound	Million Tons	Inbound	Million Tons	Internal	Million Tons
Worcester	6.2	Middlesex	42.2	Middlesex	3.2
Middlesex	5.4	Suffolk	17.7	Suffolk	2.3
Suffolk	4.9	Worcester	11.4	Worcester	1.6
Hampden	4.7	Hampden	11.3	Essex	1.2
Norfolk	3.4	Bristol	9.1	Norfolk	1.0

Source: Global Insight TRANSEARCH 2008 Release

The freight tonnage moved varies by region in Massachusetts, as shown in Figure 40 and Figure 41. These figures also indicate that areas of heaviest freight shipping origin are Suffolk County, Worcester, Middlesex and Norfolk Counties and areas with the largest volumes of freight by destination are Middlesex, Worcester, Hampden and Suffolk Counties.

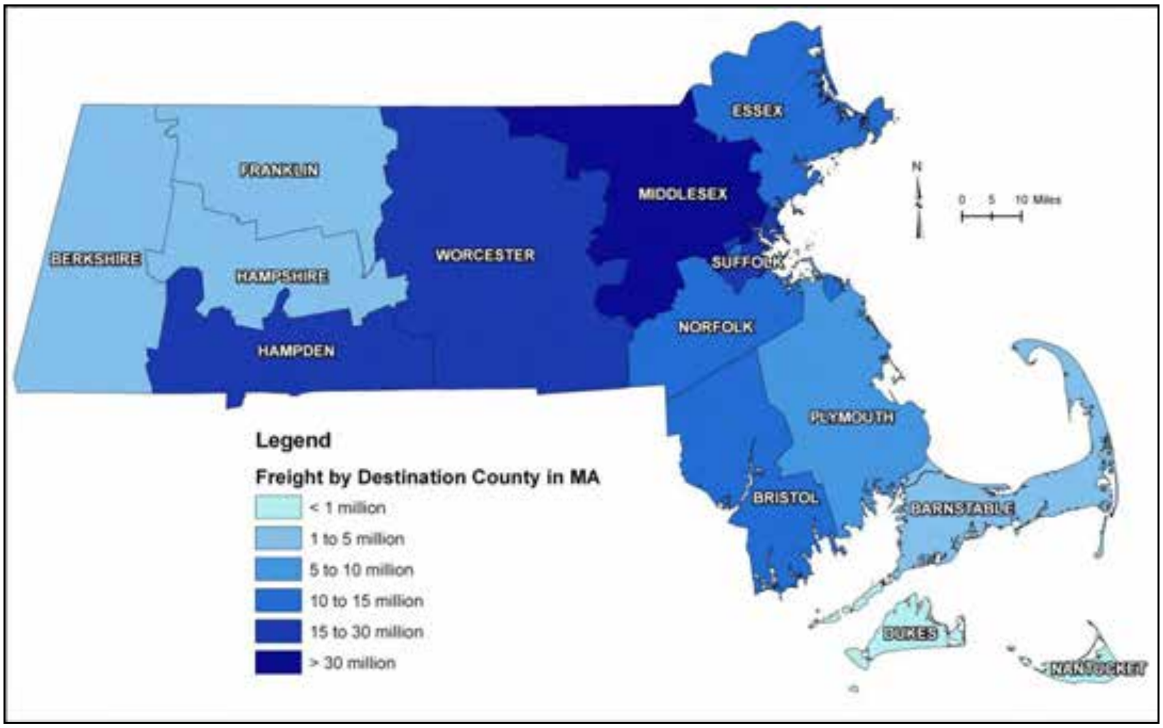
Figure 40: Freight Tonnage by Origin County in Massachusetts



Source: Global Insight TRANSEARCH 2008 Release

The large consumer markets in the eastern part of the Commonwealth, highlighted by Middlesex County, demonstrate the huge volume of freight demand for inbound goods, and provide evidence as to why freight is still so important to the state, despite a reduction in economic activity producing heavy freight products.

Figure 41: Freight Tonnage by Destination County in Massachusetts



Source: Global Insight TRANSEARCH 2008 Release

While Massachusetts does have significant trade with other states, just over one-third of the 225 million tons of freight with an origin or destination in the Commonwealth is moved internally. This is representative of internal distribution activities (secondary traffic). Table 42 shows that the relative shares of internal tonnage across the region, are relatively consistent for both origin and destination movements.

Table 42: Share of MA Internal Tonnage by Origin and Destination Region, 2007

Region	% MA Origin	% MA Destination
Berkshire	3.2%	2.6%
Pioneer Valley	6.4%	8.1%
Central	15.1%	12.6%
Greater Boston	51.0%	51.4%
Northeast	10.8%	10.2%
Southeast	11.3%	13.2%
Cape and Islands	2.2%	1.9%

Source: Global Insight TRANSEARCH 2008 Release

Table 43 provides greater insight on intra-state freight movement by county; the yellow cells denote freight movements occurring within the host county, for example 732,000 tons move within Berkshire County. The largest intra-state destination is the greater Boston region, which has 39.2 million tons terminating in the region. The next largest destination is the Southeast Region, with 10.1 million tons, followed by the Central Region bringing in 9.6 million tons. The majority of intrastate goods also originate in the greater Boston Region (38.9 million tons), followed by 11.5 million tons from the Central Region and 8.6 million tons from the Southeast Region.

Table 43: Intra-Massachusetts Movements, 2007

		Origin							
		Berkshire	**Pioneer Valley**	**Central**	**Greater Boston**	**Northeast**	**Southeast**	**Cape & Islands**	**Total**
Destination	Berkshire	723	99	103	719	120	184	3	1,951
	Pioneer Valley	398	1,574	683	2,529	445	571	18	6,218
	Central	287	758	1,619	5,037	816	1,087	22	9,626
	Greater Boston	656	1,681	6,543	21,528	4,718	3,485	574	39,185
	Northeast	210	363	980	4,090	1,219	915	37	7,814
	Southeast	183	352	1,456	4,457	823	2,129	667	10,067
	Cape & Islands	19	37	142	548	97	275	329	1,446
	Total	**2,476**	**4,864**	**11,526**	**38,907**	**8,238**	**8,646**	**1,650**	**76,307**

Source: Global Insight TRANSEARCH 2008 Release

In viewing the types of outbound shipments from each region to other regions in Massachusetts, the differences in the regional economies become more apparent. Table 44 presents these trade flows in descending order of total tonnage sent within the Commonwealth. The majority of several commodity categories are sent from the greater Boston area including petroleum and coal, transportation equipment and furniture. These represent both goods produced in the greater Boston region as well as goods moving into greater Boston from external locations for internal distribution such as petroleum products.

The shares of outbound shipments are well distributed throughout most the regions in Massachusetts. For instance, there is a high share of wood products from Pioneer Valley, primary metals from Central, chemicals from the Northeast and textiles from the Southeast.

Table 44: Internal Commodities by Region of Origin

	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands
Petroleum and Coal Products	0%	1%	7%	65%	21%	5%	0%
Stone and Gravel	4%	6%	31%	36%	7%	11%	5%
Nonmetallic Mineral Products	1%	7%	18%	48%	13%	8%	6%
Food Products	0%	20%	7%	50%	9%	12%	1%
Chemicals	1%	11%	15%	38%	20%	15%	0%
Plastics and Rubber Products	5%	24%	22%	29%	12%	7%	2%
Fabricated Metals	1%	16%	20%	29%	12%	21%	2%
Printing	3%	15%	10%	50%	10%	11%	2%
Primary Metals	0%	8%	35%	19%	10%	28%	0%
Paper	3%	26%	21%	28%	12%	10%	0%
Machinery	2%	9%	22%	42%	16%	9%	0%
Computer and Electronic Products	1%	9%	7%	43%	17%	23%	0%
Transportation Equipment	0%	16%	10%	60%	4%	10%	0%
Textiles and Leather	0%	6%	18%	37%	12%	25%	1%
Wood Products	0%	27%	16%	39%	7%	11%	1%
Furniture	0%	7%	22%	66%	2%	3%	0%
Miscellaneous Manufacturing	0%	30%	9%	39%	3%	19%	0%

Source: Global Insight TRANSEARCH 2008 Release

Table 45 shows the top internally moved commodities by tonnage for each region of origin within Massachusetts. Secondary traffic is among the top five commodities for all regions except the Cape and Islands, which reflects the large consumer market in the Commonwealth, and greater reliance on maritime freight for the Cape and Islands. Nonmetallic minerals, and clay, concrete, glass or stone are in the top five for all regions, as they are natural resource commodities that are very important for the manufacturing and construction operations that have a large presence in Massachusetts.

Table 45: Top Internal MA Movements by Origin Region

Rank	Berkshire	Pioneer Valley	Central	Greater Boston	Northeast	Southeast	Cape and Islands
1	Secondary Traffic	Secondary Traffic	Clay, Concrete, Glass or Stone	Secondary Traffic	Petroleum or Coal Products	Secondary Traffic	Clay, Concrete, Glass or Stone
2	Clay, Concrete, Glass or Stone	Clay, Concrete, Glass or Stone	Nonmetallic Minerals	Petroleum or Coal Products	Nonmetallic Minerals	Clay, Concrete, Glass or Stone	Nonmetallic Minerals
3	Nonmetallic Minerals	Food or Kindred Products	Secondary Traffic	Clay, Concrete, Glass or Stone	Secondary Traffic	Petroleum or Coal Products	Food or Kindred Products
4	Rubber or Miscellaneous Plastic	Nonmetallic Minerals	Petroleum or Coal Products	Nonmetallic Minerals	Clay, Concrete, Glass or Stone	Nonmetallic Minerals	Printed Matter
5	Printed Matter	Rubber or Miscellaneous Plastics	Food or Kindred Products	Food or Kindred Products	Food or Kindred Products	Food or Kindred Products	Rubber or Miscellaneous Plastics

Source: Global Insight TRANSEARCH 2008 Release

3.3.5 SUMMARY OF FINDINGS FROM SHIPPER INTERVIEWS AND STAKEHOLDER INPUT

To supplement available data, shippers and receivers with business in Massachusetts were interviewed. This effort included shippers involved in various industries, including chemical shipment and hazardous materials transport, paper and cardboard transport, recycling, cooking oil, intermodal transfer facilities, and food distribution.

The interviews focused on three main topics: operations, system conditions, and business conditions. Operational questions were related to origin and destination, types of products shipped, modal usage, transit times, volumes, and logistics. System conditions questions concerned the surface routes that they operate over, bottleneck or choke points, changes in the conditions, and issues causing concern for future operations. Business conditions questions focused on the impact of transportation access on the competitiveness of the business, logistics factors that potentially limit growth, and transportation investments that could impact operations and costs.

In addition, regional public meetings were held in Springfield, Worcester, Boston, and Wareham to gather the input from the public and stakeholders in the process.

The following section highlights principle freight operations and shipping issues presented by freight stakeholders.

3.3.5.1 Modal System Constraints, Issues and Bottlenecks

Truck

The primary means of transporting goods in Massachusetts is the highway system. The major concern cited is congestion. Major bottlenecks in Massachusetts that stakeholders identified include the interchange between I-90 and I-95; significant portions of Route 128; I-93 from Boston to New Hampshire; the interchange of Route 24 and I-495; and Route 44 at the Middleborough Rotary and westbound from Plymouth. Another major bottleneck farther west is the interchange between I-84 and I-90 which is the access point for goods coming in from New York, New Jersey, and Connecticut to the Boston region and points north in Maine and New Hampshire.

In the western part of Massachusetts, heavy congestion occurs in the Springfield region during peak periods, and includes bottlenecks near Exits 2 and 6 on I-90 in Lee and Chicopee respectively.

Other cited issues that limit the efficiency of truck freight include highway weight restrictions and operational regulations. Trucks are restricted to a gross weight of 80,000 pounds but containers on ships can hold up to 88,000 pounds. This leads to inefficiencies as well as problems for those companies importing or exporting heavier goods, as they cannot have containers loaded to maximum capacity for intermodal shipping. In addition, each state has the ability to set individual weight limits on their highways. This requires trucking companies to plan carefully, as loads will be constrained by the weight limit on any interstate trip.

Recent regulatory changes reduced the amount of hours that drivers can travel before needing to rest, and therefore are impacting business shipping via truck. This has raised awareness regarding the sufficiency of available rest stops, both in terms of number and location, and also in terms of adequacy of services offered at these locations as access to electrical connections for trucks to enable reduced idling The lack of rest stops was noted as a particular issue in Southeast and Central Massachusetts.

The new hours-of-service requirements dictate that companies use more drivers to move the same amount of freight. This has resulted in increased costs and longer transit times, particularly for longer distance moves. The result is higher cost for shippers. It should be noted that similar hours for service changes were also made for rail operators.

Rail

Rail is the second largest mode of freight transport in MA by tonnage when including through-trips. Like with the truck mode, shipping by rail has its own set of constraints including weight and clearance restrictions, unreliability, and high cost.

To maintain options for shipping, many businesses are looking to begin using rail or increase the use of rail. Some shippers expressed hesitation to use more rail based on service limitations or reliability and for some movements' higher costs. A cited concern is the sensitivity of costs and usage of service. An example, according to 3rd party logistics experts, was a minor increase in the railroad rates around 2008 for container shipments from New York/New Jersey to Worcester that quickly resulted in reduced loads from 350 to 100 per week. Of note for Massachusetts, the rate increase was made by the railroad originating the loads outside the Commonwealth but the effect was a shift of traffic to trucks for loads terminating in Massachusetts.

Comments were also noted that weight restrictions are a major reason rail is underutilized in Massachusetts. Currently, many of the lines in the Commonwealth are only equipped to handle 263,000 or 268,000 pound rail cars, and are not rated to handle cars with the now common weight capacity of 286,000 pounds. Thus, rail cars for many origins or destinations in Massachusetts must be loaded or reduced in transit to the lighter capacity to travel through many areas of the Commonwealth. Such rail movements carry less product per car, which increases costs per unit compared to rail shippers that can load to 286,000 pounds. This was cited as lowering the potential for increased freight moved by rail.

Restrictions of vertical clearance to handle full double-stack intermodal trains was also cited as limiting the efficiency of rail options serving Massachusetts. If the clearances were to be improved, it could increase the opportunity to divert trucks to rail from Worcester. Suggested evidence to support this assertion is the comparison of movement to the Chicago area. For routes from Chicago to New Jersey, where full double-stack clearances are available, the use of rail is generally favored over truck. This contrasts to routes from Chicago to Massachusetts, without a full double-stack intermodal rail route, where the use of trucks to move freight to Massachusetts is more cost effective even though rail is often a preferred mode for long-haul trips and Chicago to Massachusetts is slightly longer than Chicago to New Jersey.

Other cited issues for freight rail included inefficiencies in yards in Selkirk and Rotterdam Junction, NY, and East Deerfield, MA. Poor track conditions and resultant slow speeds on some lines, such as CSX's Framingham to Leominster line, are making it difficult for railroads operating on the affected lines to be able to provide adequate service and comply with the hours of service restrictions. The result is lower efficiency of operations that are then reflected in higher rates.

Despite the issues described above, the support for freight rail service in Massachusetts expressed by most stakeholders was strong. Cited examples of rail responding to shipper needs include the movement of 80 percent of the coal bound for the power plant in Holyoke to rail rather than truck. Noted expectations for increased utilization of rail were focused on intermodal opportunities. An example is the action of Providence & Worcester to fund clearance improvements on portions of its railroad to accommodate double stack rail cars. In southeast Massachusetts, the potential of increased freight rail on the lines connecting to the ports of New Bedford and Fall River is anticipated with the planned improvements at the ports. Additionally, the identified improvements planned by PAS for the route from Mechanicville, NY to Ayer are anticipated to increase use of rail.

3.3.6 FORECAST OF FUTURE FREIGHT DEMAND

International and domestic trade flows have been growing rapidly in recent years and most projections estimate that freight volume growth will continue over the next 30 years. The anticipated volumes of freight by mode have implications for future infrastructure planning, projects, and modal choice. This section of the trade flow analysis includes a range of feasible estimates for future freight movements in Massachusetts.

The primary freight forecast presented in this section is based on the Global Insight TRANSEARCH forecast, updated in 2009. For comparison purposes, two alternative commodity flow forecasts were produced based on FHWA's FAF data. The first is based upon extending the recent historical freight growth trends from 2002 to 2007, and the second applied projected annual growth rates out to 2035 to the 2007 commodity data. For more information on these alternative forecasting approaches, see Appendix 3-3.

The sections below detail the methodology and likely range of future freight tonnage in Massachusetts.

3.3.6.1 Methodology

There were two primary data sources used in the analysis.

The 2002 Freight Analysis Framework-2 (FAF^2) data is maintained by the Federal Highway Administration (FHWA), and forecasts freight tonnage and value in five year increments from 2010 to 2035 for each state and the US as a whole. In addition the FAF^2 Provisional Release data has the same 2007 commodity data available for Massachusetts. FAF^2 uses the Standardized Classification of Transported Goods (SCTG) to categorize commodities. The FAF forecasts were last updated in 2006.[21]

Global Insight's TRANSEARCH database provides similar commodity flow data, but at the county level. TRANSEARCH uses 2007 as a base year and provides forecasts for the years 2020 and 2035. TRANSEARCH uses the Standard Transportation Commodity Code (STCC) to categorize commodities. The TRANSEARCH forecast was generated in 2009, thus reflecting at least some of the current economic downturn.

Appendix 3 provides a discussion about how differing commodity code classification systems were reconciled to produce comparable forecasts.

3.3.6.2 Freight Flows Forecast, Including Through Traffic

The Massachusetts freight flow forecast based on the TRANSEARCH data indicates freight will grow by 70 percent from 2007 to 2035. The estimate includes all goods movement including through traffic.

According to TRANSEARCH data, 278.1 million tons of freight traffic moved through Massachusetts in 2007 and is projected to grow to 471.4 million tons in 2035 (see Table 46). The vast majority of the freight tonnage is moved by truck, accounting for 239.3 million tons in 2007 and 412.0 million tons in 2035, which is a 72.2 percent growth over the period (see Figure 42). This forecast is largely based on a continuation of previous trends as well as other factors such as shifts in industrial mix and projected fuel costs. The actual modal volumes and modal shares can be influenced by infrastructure, operations, and policy decisions as is more fully evaluated in Chapter 4.

The fastest growing mode is air freight, which is forecast to increase 108.8 percent from 318,894 tons to 665,813 tons in 2035. While the tonnage is relatively low, it is important to note that freight moved by air often consists of lighter, high value goods.

Table 46: Total Tonnage by Mode Including Through Traffic, (Millions of Tons), 2007, 2020, 2035

Mode	2007	2020	2035
Rail	17.9	21.8	28.9
Truck	239.3	308.2	412.0
Air	0.3	0.4	0.7
Water	13.9	17.0	20.7
Other	6.7	8.0	9.1
Total	**278.1**	**355.5**	**471.4**

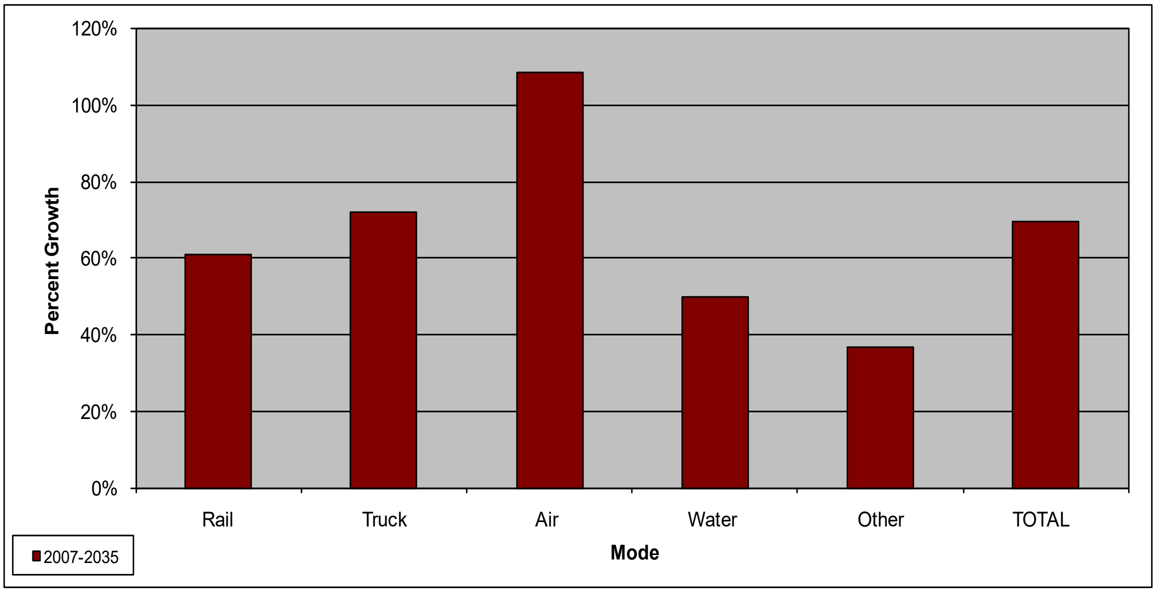
Source: Global Insight TRANSEARCH Forecast 2009 Release

Freight rail is expected to grow 61 percent over the period, increasing tonnage from 17.9 million tons to 28.9 million tons. Waterborne freight and other freight are anticipated to grow the least,

[21] The most recent version of the FAF, Version 2.2 was released in November 2006 with minor corrections to Version 2.1 that was released in January 2006.

at 49.7 percent and 36.7 percent respectively. The incremental modal growth in percentage terms from 2007 to 2035.

Figure 42: **Modal Growth Including Through Traffic, 2007-2035**



Source: Global Insight TRANSEARCH Forecast 2009 Release

While there is significant projected percent increases in freight moved, the forecast of modal share predicts minor shifts in percent moved by mode. The largest modal share will remain by truck movements, accounting for 87.4 percent of freight volumes in 2035. Despite growth of over 60 percent, the rail modal share is expected to decline from 6.5 percent to 6.1 percent based on expected commodity and shipping patterns that we will try to affect.

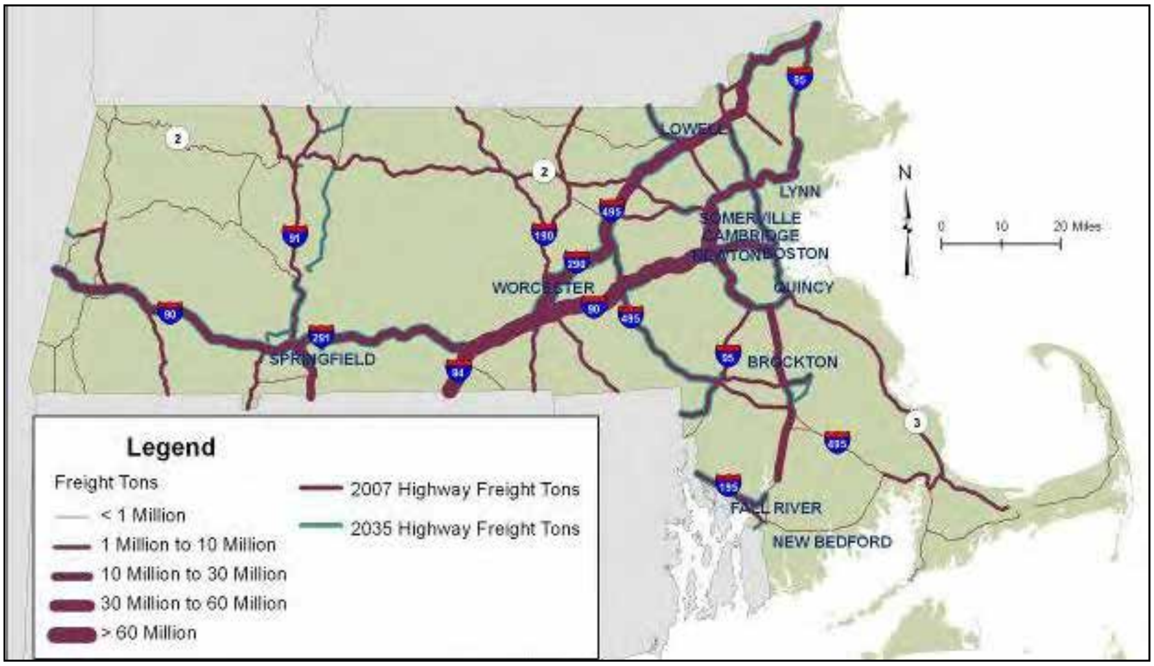
Table 47: Massachusetts Freight Modal Share Including Through Traffic, 2007, 2020, 2035

Mode	2007	2020	2035
Rail	6.45%	6.14%	6.13%
Truck	86.05%	86.71%	87.40%
Air	0.11%	0.12%	0.14%
Water	4.98%	4.78%	4.40%
Other	2.40%	2.26%	1.93%

Source: Global Insight TRANSEARCH Forecast 2009 Release

As shown below, Figure 43 indicates the projected highway freight movements in 2035 as compared to actual 2007 movements. Some of the largest growth (in teal) by highway corridor is related to through-traffic using the I-290 corridor to connect between I-90 and I-495. This is projected to be the preferred route for long-distance through-trips and reflects growth estimates, particularly in southern New Hampshire and southern Maine, that will require more goods movement to/from the Mid-Atlantic states.

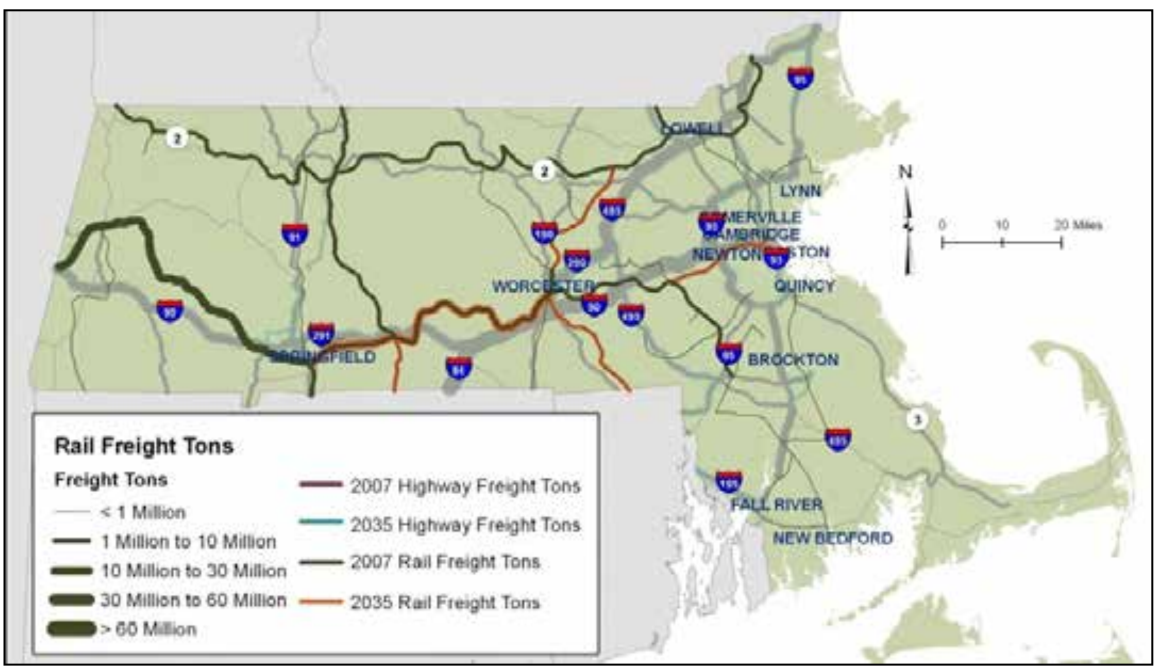
Figure 43: Massachusetts Highway Tonnage, 2007 Actual and 2035 Forecast



Source: Global Insight TRANSEARCH Forecast 2009 Release

The following map (Figure 44), displays the current and projected freight rail growth by major rail corridor.

Figure 44: Massachusetts Rail Tonnage, 2007 Actual and 2035 Forecast



Source: Global Insight TRANSEARCH Forecast 2009 Release

The projected tonnage growth for the aggregated commodity categories from 2007-2035 can be seen in Table 48. The major commodities that are anticipated to grow the most are precision instruments, electronics and machinery, miscellaneous manufacturing products, mixed freight/unknown, and waste/scrap. All of these commodities are expected to see their freight tonnage at least double over the period. The only commodity group that is expected to see a decline in freight tonnage over the period is textiles and leather, declining by approximately 35 percent.

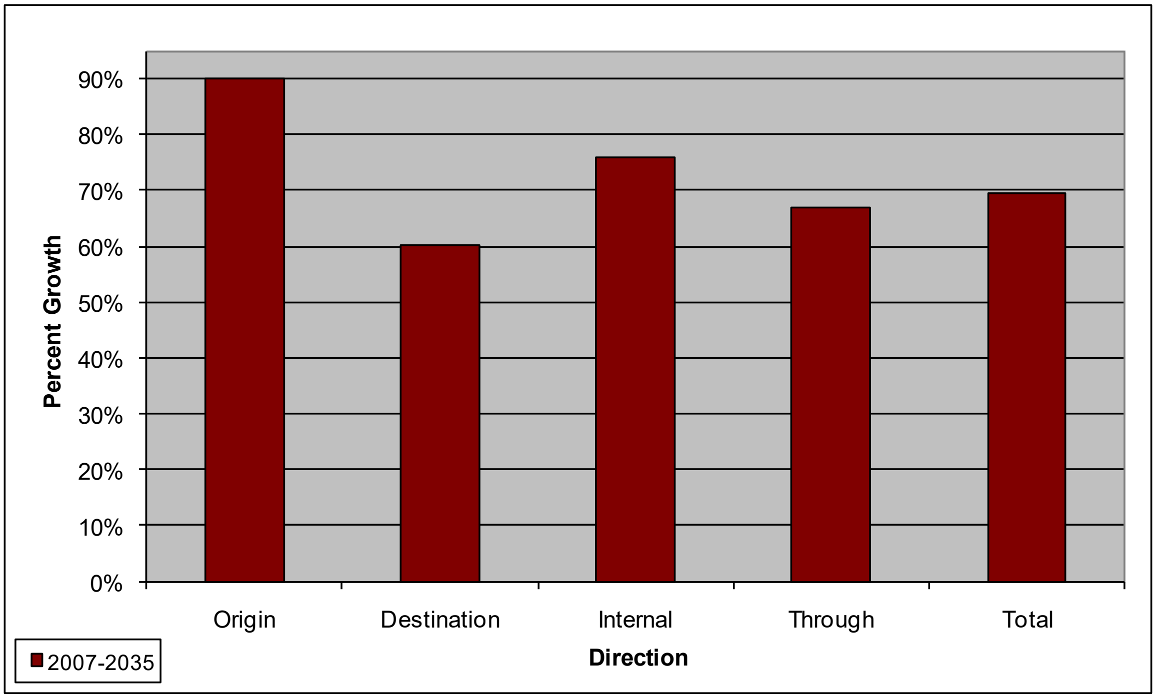
Table 48: Combined Commodity Tonnage and Growth for All Movement Directions (Millions), 2007-2035

Combined Commodity	2007	2020	2035	Growth 2007-2035
Farm Prods/food/beverages	36	45	54	50%
Stone and Sand	27	32	37	36%
Minerals and Ores	35	44	55	56%
Coal	2	3	3	21%
Gasoline, Fuel	44	58	70	57%
Chemicals/Pharmaceuticals/Fertilizer	29	37	41	40%
Plastics/Rubber	4	5	8	97%
Wood/furniture	9	11	14	57%
Paper	17	19	25	44%
Textiles/leather	2	2	1	-35%
Base Metals	15	19	23	54%
Electronics/Machinery	5	8	17	**222%**
Transportation Equipment	4	6	8	100%
Precision Instruments	1	1	3	**239%**
Miscellaneous Mfg Products	1	1	2	**176%**
Waste/Scrap	4	5	9	**103%**
Mixed Freight/Unknown	41	58	102	**148%**
Total	**278**	**355**	**471**	**70%**

Source: Global Insight TRANSEARCH Forecast 2009 Release

Forecasts of freight tonnage growth by direction and shipping pattern are shown in Figure 45 representing the growth in freight movements in Massachusetts over time. According to the TRANSEARCH forecast, freight originating in Massachusetts is anticipated to see the largest growth over the period from 2007 to 2035, increasing 90 percent while freight with a destination of Massachusetts is anticipated to grow the slowest, with 60 percent growth over the same period.

Figure 45: Freight Tonnage Growth by Direction of Movement, 2007-2035



Source: Global Insight TRANSEARCH Forecast 2009 Release

Movements internal to Massachusetts are anticipated to grow 76 percent and through traffic movements are expected to increase just below 67 percent between 2007 and 2035. The tonnage values associated with the percentages can be seen in Table 49 below. Overall freight growth for all four directions is anticipated to be approximately 69.5 percent.

Table 49: Massachusetts Freight Tonnage by Direction (Millions), 2007, 2020 and 2035

	2007	2020	2035
Origin	35	47	66
Destination	114	141	182
Internal	76	101	134
Through	53	66	89
Total	**278**	**355**	**471**

Source: Global Insight TRANSEARCH Forecast 2009 Release

Appendices

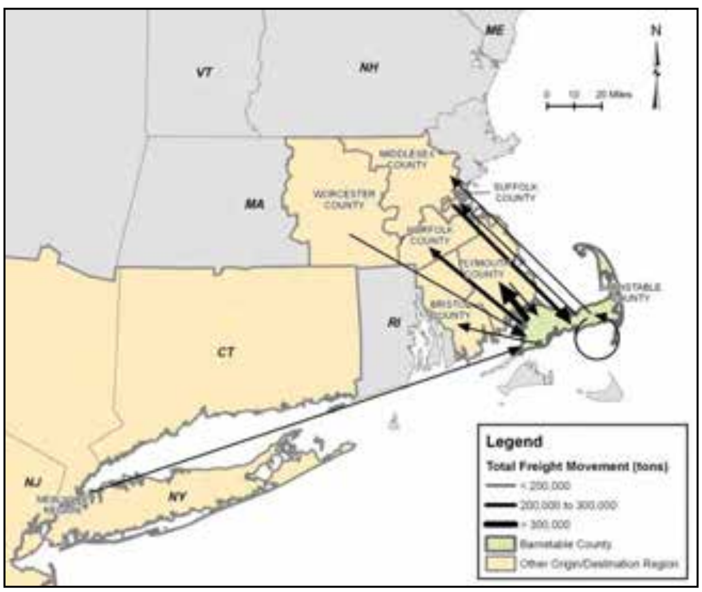
APPENDIX 3-1: TOP ORIGIN AND DESTINATION PAIRS BY MASSACHUSETTS COUNTY

This appendix provides a county-by-county assessment of major commodity flows in Massachusetts. For each county, a map depicts the top ten trading partners in terms of total tons. The freight flows represented below can be either originating or terminating in the relevant Massachusetts county. The direction of the arrow denotes the direction of the freight flow, and circular arrows denote intra-county movements.

Barnstable County

In 2007, nearly 3.4 million tons of freight moved inbound, outbound, through, or within Barnstable County. The largest freight flows are with the Eastern and Central portions of Massachusetts. The largest share, nearly 490,000 tons, was outbound to Plymouth County. The majority of freight leaving Barnstable County stays in the eastern portion of Massachusetts, moving to Norfolk, Bristol, Suffolk, and Middlesex Counties, while inbound shipments are coming from Suffolk and Worcester Counties. The New York region is the only major trading partner with Barnstable County outside of the Commonwealth.

Figure 46: Top Barnstable County Movements, 2007

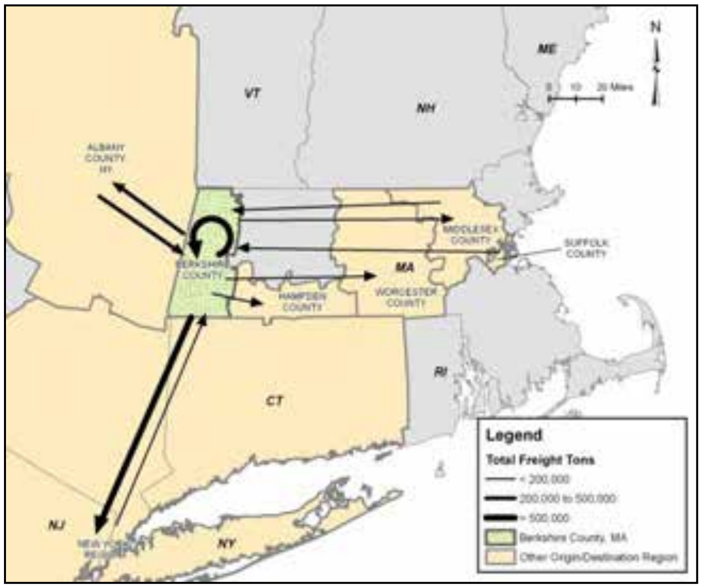


Source: Global Insight TRANSEARCH 2008 Release

Berkshire County

More than 4.9 million tons of freight moved throughout Berkshire County in 2007. Berkshire County's major trading partners are the New York and Albany, New York, regions followed by counties in the Central and Eastern portions of Massachusetts. Berkshire County shipped more than 950,000 tons to the New York region in 2007. Trade flows (inbound and outbound) with the Albany, New York, region are fairly close with 280,000 tons outbound to Albany and 240,000 tons from Albany terminating in Berkshire County. Nearly 681,000 tons of freight moved within Berkshire County. The remaining major originating and terminating movements are ~~in~~-state.”

Figure 47: Top Berkshire County Movements

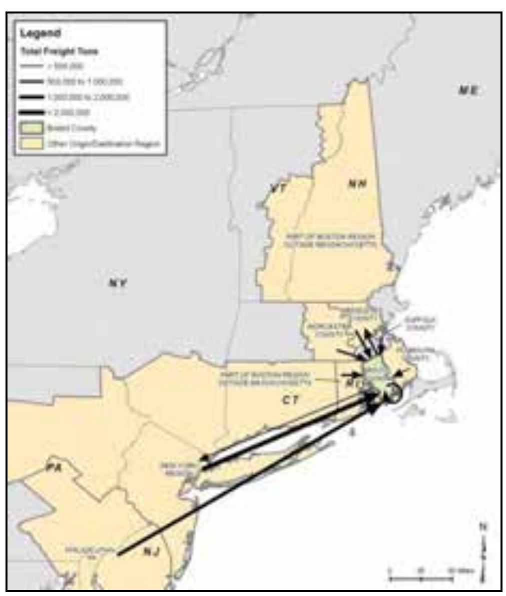


Source: Global Insight TRANSEARCH 2008 Release

Bristol County

All the major freight movements with Bristol County are either inbound or internal shipments. In total, 17 million tons of freight moved throughout Bristol County in 2007. The two largest inbound shipments are from the New York region (2 million tons) and Philadelphia region (1 million tons). Intra-state freight flows were led by Suffolk County's inbound shipment of 1 million tons and followed by 850,000 tons from Worcester County. The only major outbound movements from Bristol County were to the New York region and Middlesex County.

Figure 48: Top Bristol County Movements

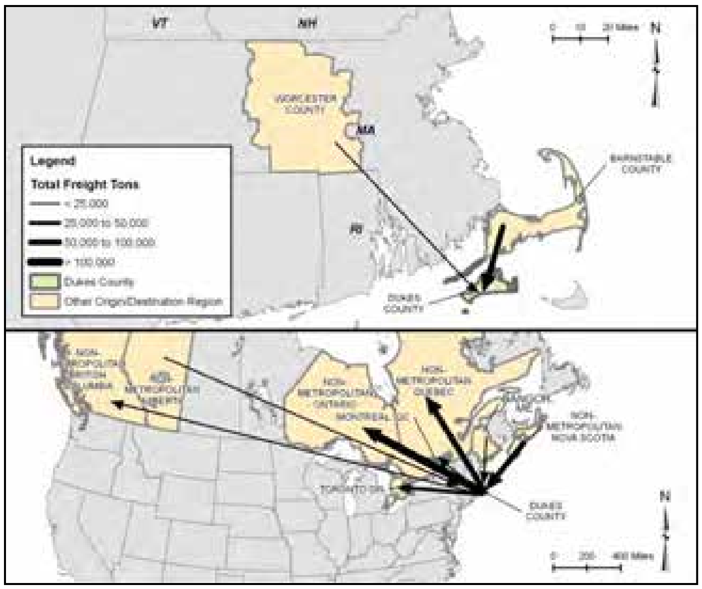


Source: Global Insight TRANSEARCH 2008 Release

Dukes County

Dukes County has the second lowest freight volume in Massachusetts for 2007, with less than 620,000 tons moved. Despite low freight volumes, Dukes County's major trading partners are mostly Canadian Provinces. The largest outbound shipment was 135,000 tons to non-metropolitan Ontario, Canada. Other major outbound shipments from Dukes County are to Quebec, Montreal, Ontario, British Columbia, and Toronto.

Figure 49: Top Dukes County Movements

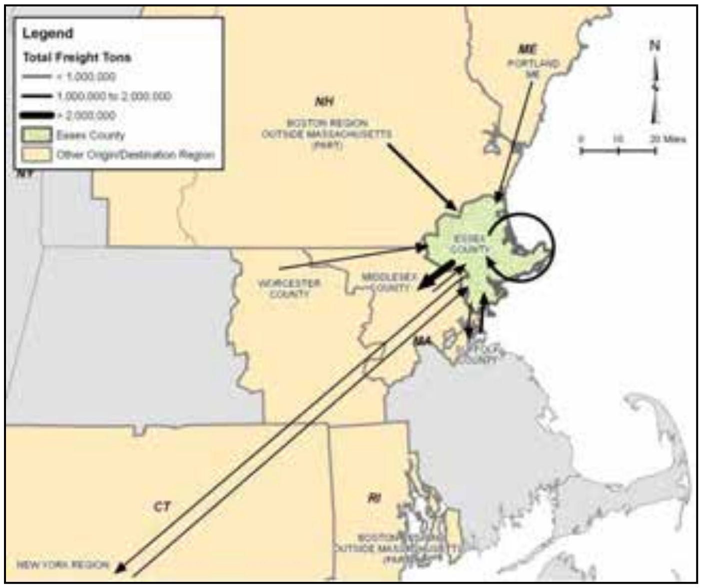


Source: Global Insight TRANSEARCH 2008 Release

Essex County

More than 19 million tons of freight moved throughout Essex County in 2007. The major freight movements are inbound to Essex County, including more than 1 million tons each from the surrounding Boston Metropolitan area (Providence, Manchester), Suffolk County, and areas within Essex County. The largest shares of outbound shipments stay within Massachusetts, with nearly 3 million tons terminating in the adjacent Middlesex County. Secondary traffic is a significant component of Essex County's freight flow.

Figure 50: Top Essex County Movements



Source: Global Insight TRANSEARCH 2008 Release

Franklin County

Franklin County had the third lowest volume of freight movements in Massachusetts for 2007, with just over 2 million tons. The largest volume of both inbound and outbound freight shipments with Franklin County are with the Albany, New York, region. The inbound shipment from the Albany area was 600,000 tons, and the outbound shipment to Albany was slightly more than 88,000 tons. The remaining top ten freight movements were inbound from elsewhere in Massachusetts, the surrounding Boston Metropolitan area (Providence, Manchester), the New York region, and non-metropolitan Nova Scotia.

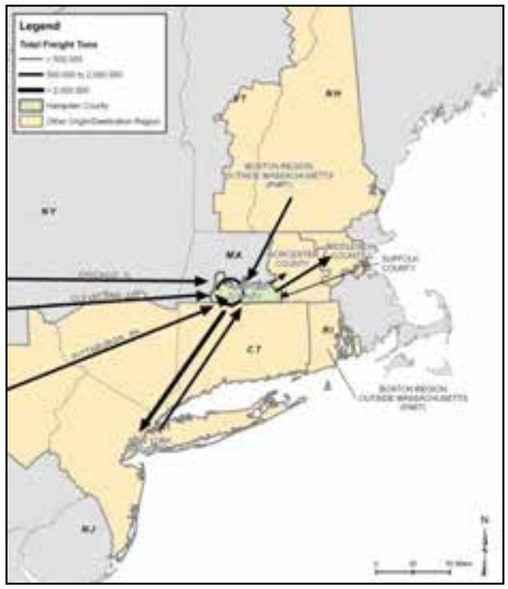
Figure 51: Top Franklin County Movements

Source: Global Insight TRANSEARCH 2008 Release

Hampden County

Although more than 20 million tons of freight flowed throughout Hampden County, it was still only the fourth highest volume of freight movements in Massachusetts in 2007. The largest share, 2.2 million tons, was inbound shipments from the New York region. The next largest movement was 830,000 tons outbound from Hampden County to Middlesex County. With the exception of the 450,000 tons outbound to Worcester County, the remaining top movements were all inbound shipments from points west including: Chicago region, the Cleveland region, the Ohio region as a whole, the Pittsburgh region, and the Pennsylvania region as a whole.

Figure 52: Top Hampden County Movements

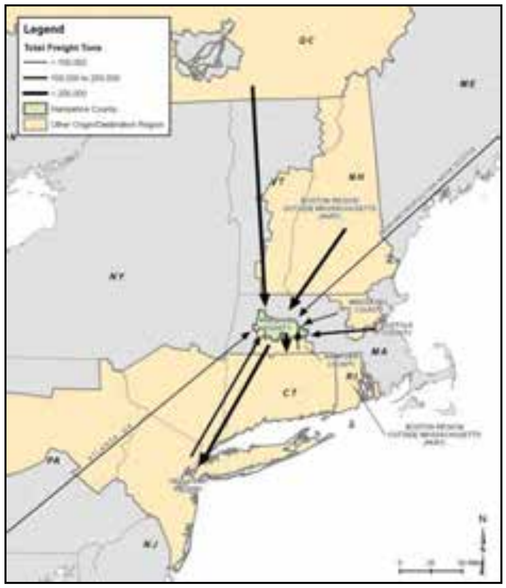


Source: Global Insight TRANSEARCH 2008 Release

Hampshire County

In 2007, 3.3 million tons of freight moved throughout Hampshire County. The largest outbound shipment, 294,000 tons, was to the New York region, followed by 284,000 tons to neighboring Hampden County. Freight flows in excess of 200,000 tons included shipments from the surrounding Boston Metropolitan area (Providence, Manchester), and non-metropolitan Quebec.

Figure 53: Top Hampshire County Movements

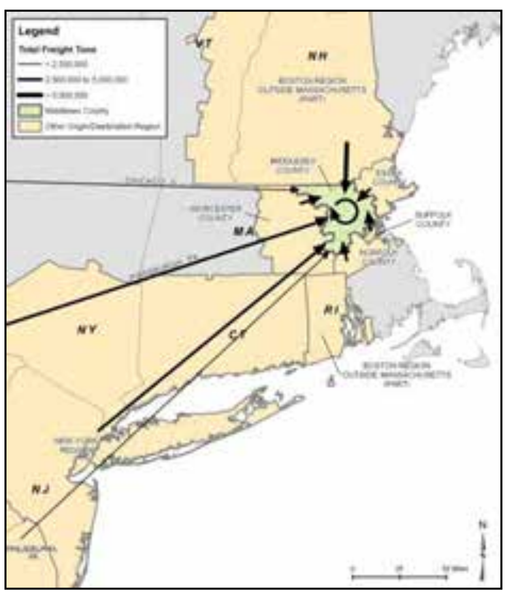


Source: Global Insight TRANSEARCH 2008 Release

Middlesex County

With more than 70 million tons moved in 2007, Middlesex County experienced the largest volume of freight movements in the Commonwealth of Massachusetts. All of the top ten movements were either inbound or internal. More than 6 million tons were from the surrounding Boston Metropolitan area (Providence, Manchester), 4.5 million were from Norfolk County, nearly 4 million each were from the New York region and Worcester County, and slightly more than 3.4 million were from Suffolk County. Other top inbound movements were from the Philadelphia and Pittsburgh regions in Pennsylvania, the Chicago region, and Essex County.

Figure 54: Top Middlesex County Movements

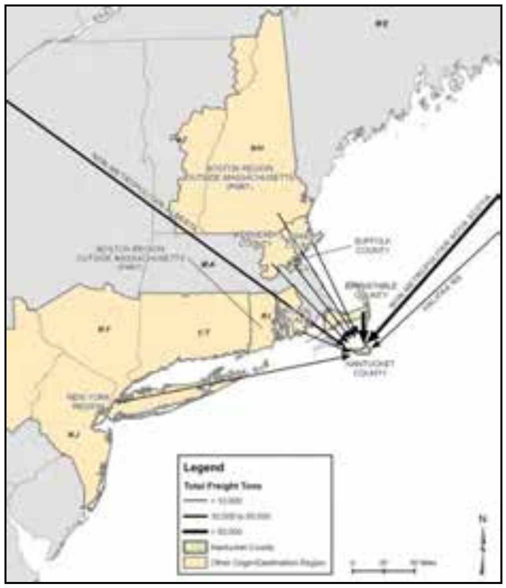


Source: Global Insight TRANSEARCH 2008 Release

Nantucket County

Nantucket County had the lowest volume of freight movement in 2007, with slightly more than 243,000 tons. Since Nantucket is an island with minimal industry aside from tourism, all major freight flows were inbound. The largest volume was 71,000 tons from non-metropolitan Nova Scotia, followed by 63,000 tons from Barnstable County. Smaller tonnage values had origins in the New York region, the surrounding Boston Metropolitan area (Providence, Manchester), Bristol, Middlesex, Essex and Suffolk Counties and Halifax, Nova Scotia.

Figure 55: Top Nantucket County Movements

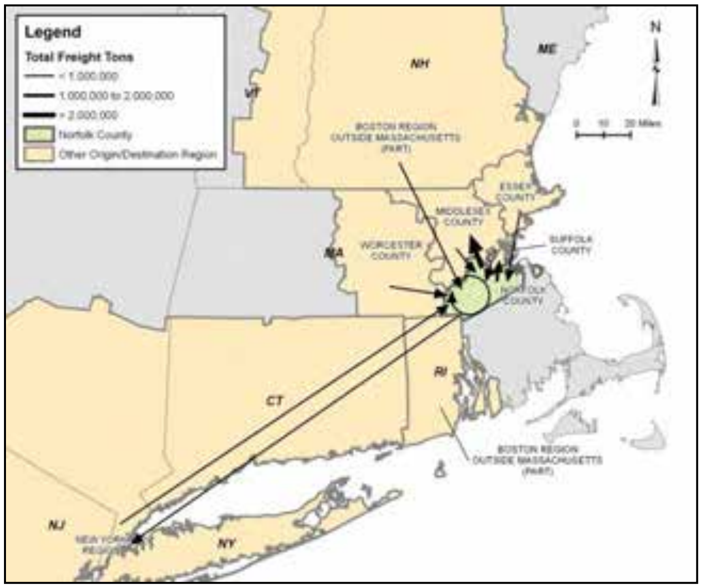


Source: Global Insight TRANSEARCH 2008 Release

Norfolk County

Freight movements in Norfolk County totaled 19.5 million tons in 2007. Like other counties on the eastern side of Massachusetts, Norfolk County's major trading partners are the adjacent and central counties of Massachusetts. The largest outbound shipment from Norfolk County was 4.5 million tons to Middlesex County. Suffolk County and Worcester County sent the most freight to Norfolk County accounting for 1.5 million tons and 1 million tons, respectively. Other major trading partners sending freight inbound include the New York region, Middlesex County, and Essex County.

Figure 56: Top Norfolk County Movements

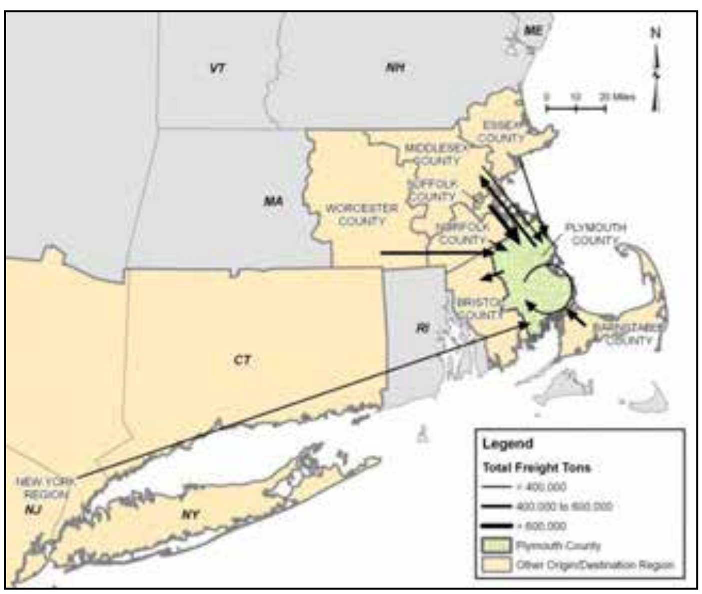


Source: Global Insight TRANSEARCH 2008 Release.

Plymouth County

Total freight movements in 2007 for Plymouth County were 8.8 million tons. As the map shows, all of the major origin and destination pairs with Plymouth County are part of the Commonwealth, with the exception of 344,000 tons inbound from the New York region. The largest inbound movement was 685,000 tons from Suffolk County, and the largest outbound movement was 496,000 tons to Middlesex County.

Figure 57: Top Plymouth County Movements



Source: Global Insight TRANSEARCH 2008 Release

Suffolk County

Suffolk County had the second largest freight flows for Massachusetts in 2007, with more than 37 million tons. Suffolk County has a significant amount of local freight traffic with over 2 million tons moved within the county. The major inbound freight flows to Suffolk County originated in non-metropolitan New Brunswick and the New York region, accounting for 3.75 million tons and 3.3 million tons, respectively. As the figure below shows, all of the major freight flows out of Suffolk County terminated in another Massachusetts county. The largest outbound shipment from Suffolk County was 3.4 million tons to Middlesex County.

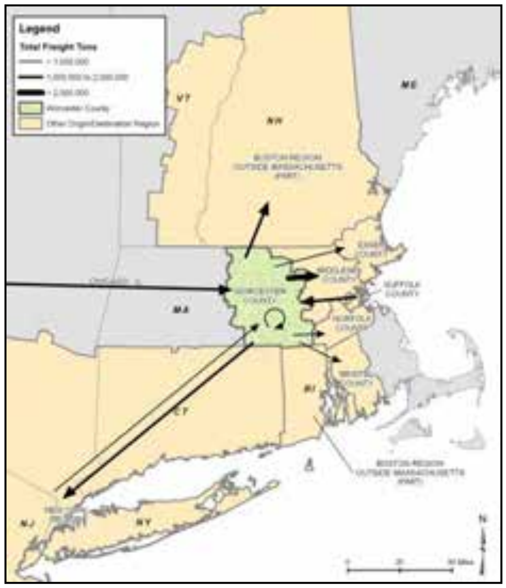
Figure 58: Top Suffolk County Movements

Source: Global Insight TRANSEARCH 2008 Release

Worcester County

Worcester County's freight flows are the third largest in Massachusetts, with 28.5 million tons moved in 2007. The largest outbound movement was nearly 3.9 million tons to Middlesex County, followed by a million tons to both the surrounding Boston Metropolitan area (Providence, Manchester) and the New York region. Although the majority of freight flows are within Massachusetts and New York region, more than 900,000 of the tons from Chicago were moved by rail. The intra-state movements between Worcester County and the other major Massachusetts counties were significant, with freight flows from Worcester County ranging from 750,000 tons to a million tons for each county.

Figure 59: Top Worcester County Movements



Source: Global Insight TRANSEARCH 2008 Release

APPENDIX 3-2: COMMODITY CODE MAP SCTG AND STCC COMMODITY CATEGORIES

Category	SCTG Number	SCTG (FAF)	STCC Number	STCC (TRANSEARCH)
Farm Products	1	Live animals/fish	1	Farm Products
	2	Cereal Grains	9	Fresh Fish or Marine Products
	3	Other agricultural products	20	Food and Kindred Products
	4	Animal Feed	21	Tobacco Products, Excluding Insecticides
	5	Meat/seafood		
	6	Milled Grain Products		
	7	Other foodstuffs		
	8	Alcoholic Beverages		
	9	Tobacco Products		
Stone and Sand	10	Building Stone	32	Clay, Concrete, Glass, or Stone
	11	Natural Sands		
	12	Gravel		
Minerals and Ores	13	Nonmetallic Minerals	10	Metallic ores
	14	Metallic Ores	14	Nonmetallic Ores, Minerals, Excluding Fuels
	31	Nonmetal Mineral Products		
Coal	15	Coal	11	Coal
Fuel and Gas	19	Coal- n.e.c.	13	Crude Petroleum, Natural Gas or Gasoline
	16	Crude Petroleum	29	Petroleum or Coal Products
	17	Gasoline		
	18	Fuel Oils		
Chemicals, Pharmaceuticals and Fertilizers	20	Basic Chemicals	28	Chemicals or Allied Products
	21	Pharmaceuticals		
	22	Fertilizers		
	23	Chemical Products		
Plastics and Rubber	24	Plastics/Rubber	30	Rubber or Miscellaneous Plastics Products
Wood and Furniture	25	Logs	8	Forest Products
	26	Wood Products	24	Lumber or Wood Products, Excluding Furniture
	39	Furniture	25	Furniture or Fixtures
Paper	27	Newsprint/paper	26	Pulp, Paper, or Allied Products
	28	Paper articles	27	Printed Matter
	29	Printed Products		
Textiles and Leather	30	Textiles/leather	22	Textile Mill Products
			23	Apparel, Other Finished Textile Products, Knit Apparel
			31	Leather or Leather Products
Base Metals	32	Base Metals	33	Primary Metal Products
	33	Articles- Base Metal	34	Fabricated Metal Products

Electronics and Machinery	34	Machinery	35	Machinery, Excluding Electrical
	35	Electronics	36	Electrical Machinery, Equipment or Supplies
Transportation Equipment	36	Motorized Vehicles	37	Transportation Equipment
	37	Transportation Equipment		
Precision Instruments	38	Precision Instruments	38	Instruments, Photographic Goods, Optical Goods, Watches, or Clocks
Miscellaneous Manufacturing Products	40	Misc. Manufacturing Products	19	Ordnance or Accessories
			39	Miscellaneous Products of Manufacturing
Waste and Scrap	41	Waste/Scrap	40	Waste or Scrap Materials Not Identified by Producing Industry
			48	Waste Hazardous Materials or Waste Hazardous Substances
Mixed Freight and Unknown	42	Mixed Freight	41	Miscellaneous Freight Shipments
	43	Unknown	42	Shipping Containers
			43	Mail or Contract Traffic
			44	Freight Forwarder Traffic
			45	Shipper Association Traffic
			46	Miscellaneous Mixed Shipments
			47	Small Packaged Freight Shipments
			49	Hazardous Materials or Substances
			50	Secondary Traffic

STCC Commodity Examples

STCC Code	Commodity Description	Examples
1	**Farm Products**	**Live animals, fruits, vegetables, etc**
	Raw cotton, Grail, Seeds, Fruits, Bulbs, Vegetables, Livestock, Dairy Farm Products, Live Poultry	
8	**Forest Products**	**Natural rubber and other gums**
	Barks or Gums and other Miscellaneous Products	
9	**Fresh Fish or Marine Products**	**Fresh salmon, fish, etc.**
	Fresh Fish or Whale Products, Marine Products, Fish Hatcheries	
10	**Metallic ores**	**Aluminum, crude iron, copper, etc.**
	Iron, Copper, Lead, Zinc, Gold, Silver, Bauxite, Chromium, Other Miscellaneous Ores	
11	**Coal**	**Coal**
	Anthracite, Bituminous Coal, Lignite	
13	**Crude Petroleum, Natural Gas or Gasoline**	**Petroleum Oil, Natural Gas**
	Crude Petroleum, Natural Gas, Natural Gasoline	
14	**Nonmetallic Ores, Minerals, Excluding Fuels**	**Sulfur, Rock Salt, Rough Stone**
	Dimension Stone, Broken Stone, Gravel or Sand, Clay Ceramic, Crude Fertilizer Mineral, Water	
19	**Ordnance or Accessories**	**Guns, Missiles**
	Guns, Guided Missiles, Ammo, Tracked Combat Vehicle or Parts, Military Fire Control Equipment	
20	**Food and Kindred Products**	**Fresh or Frozen Meat, Processed or Preserved Foods**

	Meat, Processed Poultry or Eggs, Processed Butter or Milk, Cheese, Dehydrated or Pickled Vegetables, Canned Food, Pet Food, Candy, Bread, Alcohol, Nuts	
21	**Tobacco Products, Excluding Insecticides**	**Cigarettes, Cigars**
	Cigarettes, Cigars, Chewing Tobacco, Stemmed or Re-dried Tobacco	
22	**Textile Mill Products**	**Yarn, Cloth, Blankets, Batting**
	Cotton Fabrics, Knit Fabrics, Woven Carpets, Yarn, Thread, Felt and Lace Goods	
23	**Apparel or Other Finished Textile Products or Knit Apparel**	**Garment Bags, Cotton Clothing**
	Clothing, Millinery, Caps, Fur, Robes, Coats, Canvas Products, Curtains	
24	**Lumber or Wood Products, Excluding Furniture**	**Logs, Wood Chips, Particle Board**
	Primary Forest Materials, Lumber, Cabinets, Treated Wood Products, Ladders	
25	**Furniture or Fixtures**	**Venetian Blinds, Baby Furniture**
	Chairs, Tables, Sofas, Buffets, Beds, Dressers, Cabinets or Cases, Lockers, Blinds and Shades	
26	**Pulp, Paper, or Allied Products**	**Packaging, Writing Paper**
	Pulp, Paper, Fiber, Envelopes, Paper Bags, Wallpaper, Sanitary Paper Products, Containers	
27	**Printed Matter**	**Books, Newspaper**
	Newspapers, Periodicals, Books, Greeting Cards, Blank Books	
28	**Chemicals or Allied Products**	**Carbon Dioxide, Dyes, Paint, Printing Ink**
	Industrial Chemicals, Industrial Gases, Dyes, Plastic mater or Synthetic Fibers, Drugs, Soap, Specialty Cleaning Preparations, Explosives, Adhesives, Paints, Fertilizers	
29	**Petroleum or Coal Products**	**Asphalt, Coal Gas, Tar Paper**
	Petroleum Refining Products, Liquefied Gases, Asphalt Paving Blocks or Mix	
30	**Rubber or Miscellaneous Plastics Products**	**Floor or Ceiling Covers, Boots or Shoes**
	Tires, Rubber or Plastic Footwear, Reclaimed Rubber, Plastic Hose or Belting	
31	**Leather or Leather Products**	**Leather Cattle, Leather**
	Leather, Industrial Leather Belting, Boot or Shoe Cut Stock, Leather Footwear, Leather Gloves, Leather Luggage or Handbags	
32	**Clay, Concrete, Glass, or Stone Products**	**Slate, Carved Granite, Ceramics, Glass Products**
	Flat Glass, Cement, Ceramic Floor or Wall Tile, Refractories, Porcelain Electric Supplies, Concrete Products, Gypsum Products, Abrasive Products, Gaskets or Packing, Mineral Wool	
33	**Primary Metal Products**	**Wire Rods, Pipe, Castings, Nails and Screws**
	Blast Furnace, Primary Iron or Steel Products, Steel Wire or Nails, Iron or Steel Castings, Alloy Castings or Basic Shapes, Metal Forgings	
34	**Fabricated Metal Products**	**Shipping Canisters, Cans, Solar Panels**
	Metal Cans, Cutlery, Tools, Hardware, Plumbing Fixtures, Heating Equipment, Metal Doors, Sheet Metal Products, Bolts, Nuts, Screws, Metal Stampings, Steel Springs, Valves or Pipe Fittings	
35	**Machinery, Excluding Electrical**	**Scales, General Industrial, Production Machinery**
	Steam Engines, Farm Machinery or Equipment, Elevators or Escalators, Conveyors or Parts, Industrial Trucks, Machine Tool Accessories, Textile Machinery or Parts, Printing Trades Machinery, Industrial Pumps, Ball Bearings, Typewriters or Parts, Refrigeration Machinery	
36	**Electrical Machinery, Equipment or Supplies**	**Electric Motors, Telephones, Circuit Breakers**
	Electric Measuring Instruments, Switchgear, Motors of Generators, Welding Apparatus, Household Cooking Equipment, Household Equipment, Electric Lamps and Lighting Fixtures, Electronic Tubes, Storage Batteries or Plates, Radio or TV Receiving Sets	
37	**Transportation Equipment**	**Automobiles, Chassis, Motorcycles, Airplanes**
	Motor Vehicles, Truck Trailers, Aircraft, Ships or Boats, Railroad Cars, Motorcycles	

38	**Instruments, Photographic Goods, Optical Goods, Watches, or Clocks**	**Camera Stands, Dental Goods, Syringes**
	Scientific Equipment, Optical Instruments or Lenses, Mechanical Measuring or Control Equipment, Surgical or Medical Instruments, Orthopedic or Prosthetic Supplies, Dental Equipment or Supplies, Photographic Equipment of Supplies, Ophthalmic or Opticians Goods, Watches or Clocks	
39	**Miscellaneous Products of Manufacturing**	**Potpourri, Needles, Pianos**
	Jewelry, Silverware, Musical Instruments, Games, Dolls, Sporting Goods, Pens and Pencils, Carbon Paper, Brooms, Morticians Goods, Matches	
40	**Waste or Scrap Materials Not Identified by Producing Industry**	**Construction Debris, Scrap**
	Ashes, Metal Scrap, Wood Scrap, Paper Waste, Chemical Waste, Misc. Waste	
41	**Miscellaneous Freight Shipments**	**Otherwise Unclassified Shipments, Special Commodities**
42	**Shipping Containers**	**Empty Shipping Equipment**
	Shipping Containers, Semi-trailers Returned Empty, Empty Equipment on Reverse Route	
43	**Mail or Contract Traffic**	
	Includes USPS by Rail and Air, UPS and FedEx Overnight Air	
44	**Freight Forwarder Traffic**	**Third Party Logistics Providers**
	Dispatches Shipments via Asset Based Carriers and Books or Arranges for those Shipments	
45	**Shipper Association Traffic**	
46	**Miscellaneous Mixed Shipments**	
	Fak Shipments and Mixed Shipments Under Multiple STCC Codes	
47	**Small Packaged Freight Shipments**	
	Small Packaged Shipments	
48	**Waste Hazardous Materials or Waste Hazardous Substances**	
	Waste Flammable Liquids, Flammable or Combustible Liquids, Waste Solids, Waste Corrosive Materials, Other Waste Materials	
49	**Hazardous Materials or Substances**	**Chemicals, Acyclic Alcohols, Liquid Plastics**
	Flammable, Combustible, Poisonous, Radioactive, Corrosive or Otherwise Regulated Materials	
50	**Secondary traffic**	
	Includes UPS and other ground mail shipments	

SCTG Commodity Codes and Examples

SCTG Code	Commodity Description	Examples
1	**Live Animals and Fish**	**Bovine, Swine, Poultry, Fish**
	Beef, Chicken, Pork, Tuna, Salmon	
2	**Cereal Grains (including seeds)**	
	Wheat, Corn, Rye, Barley, Oats, Grain Sorghum	
3	**Other Agricultural Products**	**Vegetables, Fruit and Nuts, Other Agricultural Products**
	Potatoes, Lettuce, Frozen Vegetables, Oranges, Raisins, Shelled Nuts, Raw Cotton, Sugar Cane	
4	**Animal Feed and Products of Animal Origin, N.E.C.**	
	Straw, Inedible Flours, Raw Hides, Pet Food, Solid Residues of Cereals, Eggs	
5	**Meat, Fish and Seafood, and their Preparations**	
	Meat, Poultry, Fish, Aquatic Invertebrates, Preparations, Extracts and Juices of Meat/Fish	
6	**Milled Grain Products and Preparations, and Bakery Products**	**Milled Grain Products, Bakery Products and Preparations of Cereals, Flour, Starch or Milk**

	Flour, Malt, Milled Rice, Pasta, Breakfast Cereal, Baked Products, Rice Preparations	
	Other Prepared Foodstuffs, and Fats and Oils	**Dairy Products, Processed or Prepared Vegetables, Fruit or Nuts, n.e.c., and Juices, Coffee, Tea and Spices, Animal or Vegetable Fats and Oils, Sugar Confectionary and Cocoa Products, Edible Preparations- n.e.c.**
7	Milk, Cheese, Potato Chips, Jam, Tea, Coffee, Corn Oil, Glucose, Chocolate, Tomato Sauce, Soft Drinks	
	Alcoholic Beverages and Tobacco Products	
8, 9	Beer, Wine, Spirits, Cigarettes, Denatured Ethyl Alcohol, Tobacco Products n.e.c.	
	Stone and Sands, except Metal Bearing Sands	
10, 11, 12	Building Stone, Limestone, Gravel, Crushed Stone n.e.c.	
	Non-Metallic Minerals N.E.C.	
13	Table Salt, Sulfur, asbestos, Pumice, Clay, Non-Metallic Minerals n.e.c	
	Metallic Ores and Concentrates	
14	Iron, Copper, Nickel, Zinc, Lead, Uranium, Thorium, Titanium, Ores n.e.c	
	Coal	
15	Bituminous Coal, Anthracite, Lignite, Agglomerated Coal	
	Crude Petroleum, Gasoline, Fuel Oils, and Aviation Turbine Fuel	
16, 17, 18	Crude Petroleum Oil, Gasoline, Aviation Turbine Fuel, Diesel	
	Coal and Petroleum Products, n.e.c.	
19	Lubricating Oils, Kerosene, Natural Gas, Propane, Butane, Other Coal Products n.e.c.	
	Basic Chemicals	**Inorganic & Organic Chemicals**
20	Chlorine, Carbon Dioxide, Organic Dyes, Inorganic Pigments	
	Pharmaceutical Products	
21	Anything for Medical Use	
	Fertilizers	
22	Animal, Vegetable, Chemical and Mineral Fertilizers	
	Chemical Products & Preparations n.e.c.	
23	Inks, Perfumes, Insecticides, Glues	
	Plastics and Rubber	**Plastics and Rubber in Primary Forms, Articles of Plastic, Articles of Rubber**
24	Natural Rubber, Plastic Utensils, Cellulose Derivatives, Tires, Rubber Hoses	
	Logs and Other Wood in the Rough	
25	Logs for Pulping, Logs for Lumber, Fuel Wood	
	Wood Products	
26	Wood Chips, Treated/Untreated Lumber, Shingles, Wood Packing, Plywood	
	Pulp, Newsprint, Paper and Paperboard	**Pulp of Fibrous Cellulosic Materials, Paper and Paperboard, in Large Rolls or Sheets**
27	Wood Pulp, Newsprint in Large Rolls/Sheets, Toilet or Facial Tissue, Uncoated Paperboard in Rolls	
	Paper or Paperboard Articles	
28	Toilet Paper, Paper Bags, Wallpaper, Envelopes, Stationary Paper	
	Printed Products	
29	Books, Brochures, Newspapers, Periodicals, Postcards	
30	**Textiles, Leather and Articles of Textiles or Leather**	**Textiles and Articles of Textiles, Leather and Articles of Leather**

	Yarns, Thread, Knitted Fabrics, Carpets, Textile Clothing, Leather Footwear, Leather Apparel	
	Non-Metallic Minerals Products	**Hydraulic Cements, Ceramic Products, Glass and Glass Products, Other Non-Metallic Mineral Products**
31	Ceramic Pipes, Porcelain Items, Glassware, Asphalt Shingles, Gypsum, Concrete	
	Base Metal in Primary or Semi-Finished Forms and in Finished Basic Shapes	
32	Iron, Steel and Copper Bars, Rods and Wire, Lead Powder, Lead Bars	
	Articles of Base Metal	**Pipes, Tubes and Fittings, Structures and Structural Parts, Hand Tools, Cutlery, Interchangeable Tools for Hand- or Machine-Tools, Hardware, and Industrial Fasteners, Other Articles of Base Metal**
33	Iron and Steel in Primary Forms or Powders, Pipes, Tubes, Doors, Cutlery, Railroad Construction Material	
	Machinery	**Turbines, Boilers, Internal Combustion Engines, and Other Non-Electric Motors and Engines, Other Mechanical Machinery**
34	Internal Combustion Engine Parts, Turbo-Jets, Turbo-Propellers, Nuclear Reactors, Fans, Refrigerators	
	Electronic and Other Electrical Equipment and Components, and Office Equipment	
35	Electric motors, electric cooking appliances, telephones, computer software, TVs, capacitors, lighting	
	Motorized and Other Vehicles	**Vehicles, Motor Vehicle Parts**
36	Automobiles, Tractors, Bicycles, Brakes, Motorcycles	
	Transportation Equipment n.e.c.	**Railway Equipment, Aircraft and Spacecraft, Ships, Boats and Floating Structures**
37	Railway Locomotives, Aircraft, Spacecraft, Pleasure Boats, Commercial Ships	
	Precision Instruments and Apparatus	
38	Eyewear, Photocopying Machines, X-Ray Machines, Surgical Instruments, Measuring Instruments	
	Furniture, Mattresses and Mattress Supports, Lamps, Lighting Fittings, and Illuminated Signs	
39	Mattresses, Household/Office Furniture, Lamps, Illuminated Signs or Nameplates	
	Miscellaneous Manufactured Products	
40	Arms, Munitions, Ammunition, Toys, Sporting Equipment, Clocks, Jewelry, Art, Antiques, Pearls, Brooms	
	Waste and Scrap	
41	Metal Slag, Ash and Residues, Sawdust and Wood Waste, Paper Waste, Glass Waste	
	Mixed Freight	
43	Grocery/Convenience Store Items, Restaurant Supplies, Office Supplies, Plumbing Supplies, Miscellaneous	

APPENDIX 3-3: FORECAST COMPARISON

Since TRANSEARCH and FAF^2 use two different commodity classification systems (STCC and SCTG respectively), commodity categories were reconciled into aggregate general commodity categories that were comparable between the two datasets. Once the 2007 base years for both the FAF^2 and TRANSEARCH were reconciled into this comparable commodity framework, the forecasts could be estimated. The comparison of the commodities, as well as a description of each category's commodity composition, can be found in Appendix 3-1. Also for comparison purposes, the mode category ―pipeline and unknown" was removed from the FAF^2 data since pipeline movements are not included in the TRANSEARCH database.

Forecasts

- The first forecast is the TRANSEARCH forecast created by Global Insight. The forecast includes 2007 as a base year and projects to years 2020 and 2035. The commodity categories are aggregated for comparison to the forecasts derived from the FAF^2 database. Similar to the 2007 data, the TRANSEARCH forecasts include *all* goods movement in Massachusetts, including through traffic. Later in the report, through traffic will be excluded to compare the forecast with those calculated from the FAF^2 data.
- The second forecast used the FAF^2 Provisional 2007 data to calculate the compound annual growth rate for each aggregated commodity category between the years 2002 and 2007. These historical growth rates were then applied to the 2007 TRANSEARCH data to obtain inbound, outbound, and internal commodity movement estimates by mode for the year 2035.
- The third forecast calculated a compound annual growth rate between the year 2002 and 2035 from the FAF^2 for each of the aggregated commodities. Like the first forecast, the compound annual growth rates were calculated and then applied to the 2007 TRANSEARCH aggregated commodity tonnage to generate tonnage estimates for 2035.

Forecast

The different forecast methodologies provided a possible range of total freight tonnage growth of between 70 percent and 109 percent by 2035. The TRANSEARCH forecast, being the most conservative estimate, predicts a 70 percent growth in freight movements in Massachusetts from 2007 to 2035. For 2007, TRANSEARCH estimates a total of 224.8 million tons with an origin or destination in Massachusetts, and 382.4 million tons in 2035.

The FAF^2 data shows an increase from 211.9 million tons in 2007 to 442.1 million tons in 2035, translating to growth of 109 percent. Applying the FAF^2 2002-2035 growth rate to the 2007 TRANSEARCH data generates a 96 percent growth rate, increasing tonnage from 224.8 million to 441.5 million. Using the FAF^2 2002-2007 growth rate and applying it to the TRANSEARCH data results in tonnage increasing 108 percent from 224.8 million tons in 2007 to 467.5 million tons in 2035. The results are presented in Table 50. Regardless of the forecast method or data source used, freight flows are expected to increase significantly in Massachusetts over the next 20 to 30 years.

Table 50: Growth Rates from Each Forecast Method

Method	Percentage Growth 2007-2035
TRANSEARCH	70%
FAF^2 Projected Growth Rates	96%
FAF^2 Historical Growth Rates	108%

Forecast Comparison, Excluding Through Traffic

The 2007 freight tonnage by commodity compared to the reconciled aggregate commodity forecasts for the year 2035 is shown below. The highest growth commodity levels are indicated in bold. Despite the differences in the individual forecasts, the major commodities that will be shipped throughout Massachusetts are mixed freight/unknown, gasoline and fuel, minerals and ores, stone and sand, food products and chemicals and pharmaceuticals.

Table 51: Projected Future Freight Movements in MA by Aggregated Commodity Excluding Through Traffic (Millions of Tons)

		2002-2007 Growth Rate	2002-2035 Growth Rate	TRANSEARCH
Commodity	**2007**	**2035**	**2035**	**2035**
Farm Prods/food/beverages	26.7	**37.3**	**49.2**	**38.4**
Stone and Sand	23.8	**55.3**	**36.8**	**32.5**
Minerals and Ores	33.4	**62.5**	**55.6**	**52.6**
Coal	0.8	**106.6**	0.6	0.9
Gasoline, Fuel	40.3	**68.1**	**72.0**	**64.3**
Chemicals/Pharmaceuticals/Fertilizer	21.7	**37.0**	**46.3**	**28.8**
Plastics/Rubber	3.0	4.4	6.1	5.5
Wood/furniture	6.1	6.9	8.9	9.6
Paper	8.3	10.3	10.1	13.1
Textiles/leather	1.4	1.5	0.9	0.8
Base Metals	11.0	14.0	18.9	17.0
Electronics/Machinery	3.8	5.5	10.5	12.8
Transportation Equipment	2.6	3.3	5.9	5.3
Precision Instruments	0.6	1.2	2.0	2.1
Miscellaneous Mfg Products	0.6	0.7	2.4	1.6
Waste/Scrap	2.9	4.5	7.1	5.7
Mixed Freight/Unknown	37.5	**48.4**	**108.2**	**91.4**
Total	**224.8**	**467.5**	**441.5**	**382.4**

Source: Global Insight TRANSEARCH database (excluding through traffic) 2008 and FAF^2

The total percentage growth from 2007 to 2035, using each of the three comparable forecasts, is shown in the table below. The highest growth rates are indicated in bold. Given the industry mix in Massachusetts, it is logical that these commodities would have the highest tonnages. In terms of percentage growth, electronics and machinery, precision instruments, and transportation equipment are anticipated to grow significantly. Many of the commodities with the highest percentage growth in freight tonnage correspond to industries that have seen growth in Massachusetts.

Table 52: Projected Future Freight Movements in MA by Percentage Growth Excluding Through Traffic

Commodity	2002-2007 Growth Rate (%) 2035	2002-2035 Growth Rate (%) 2035	TRANSEARCH Growth Rate (%) 2035
Farm Prods/food/beverages	40%	84%	44%
Stone and Sand	**132%**	55%	37%
Minerals and Ores	87%	66%	57%
Coal	**13225%**	-25%	13%
Gasoline, Fuel	69%	79%	60%
Chemicals/Pharmaceuticals/Fertilizer	71%	**113%**	33%
Plastics/Rubber	47%	**103%**	83%
Wood/furniture	13%	46%	57%
Paper	24%	22%	58%
Textiles/leather	7%	-36%	-43%
Base Metals	27%	72%	55%
Electronics/Machinery	45%	**176%**	**237%**
Transportation Equipment	27%	**127%**	**104%**
Precision Instruments	**100%**	**233%**	**250%**
Miscellaneous Mfg Products	17%	**300%**	**167%**
Waste/Scrap	55%	**145%**	97%
Mixed Freight/Unknown	29%	**189%**	**144%**
Total	**108%**	**96%**	**70%**

Source: Global Insight TRANSEARCH Database (excluding through traffic) 2008 Release and FAF^2

Freight Forecasts by Mode

The percent of freight originating, terminating, or traveling within Massachusetts by mode according to the FAF^2 is presented in the following table. As expected, the truck mode transports the majority of the tonnage within Massachusetts, and it remains the dominant transportation mode in 2035. The share of other freight modal activity is projected to increase over the period. Rail and water percentage shares both decline over time, but the overall tonnage carried by these modes increase.

Table 53: Freight Modal Share for Total Origin, Destination, and Internal Movements

	2007	2020	2035
Rail	3.2%	3.1%	2.6%
Truck	95.5%	95.9%	96.1%
Air	0.1%	0.1%	0.1%
Water	0.5%	0.1%	0.0%
Other	0.7%	0.9%	1.1%
Total	100.0%	100.0%	100.0%

Source: FAF^2 2002 Data and 2007 Provisional Data Release

Table 54: Freight Modal Share Excluding Through Traffic, 2007, 2020, 2030

	FAF^2			TRANSEARCH		
Mode	**2007**	**2020**	**2035**	**2007**	**2020**	**2035**
Rail	3.2%	3.1%	2.6%	5.0%	5.0%	5.1%
Truck	95.5%	95.9%	96.1%	87.2%	87.6%	88.1%
Air	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Water	0.5%	0.1%	0.0%	6.2%	5.9%	5.4%
Other	0.8%	0.9%	1.2%	1.5%	1.4%	1.1%

Source: FAF^2 2007 Provisional Data and 2002 Data, TRANSEARCH Forecast
NOTE: The TRANSEARCH data excludes Through Traffic and FAF^2 data excludes —Pipeline and Unknown" data.

Comparing the FAF^2 and TRANSEARCH modal forecasts for goods moving internally or with an origin or destination in Massachusetts, it is apparent that the modal shares vary significantly for both water and truck. The greatest difference in modal percentage share is for the truck mode where FAF^2 estimates 95.5 percent of tonnage transported by truck, compared to 87.2 percent for TRANSEARCH in 2007. Both truck shares are projected to grow between 2007 and 2035. TRANSEARCH shows a lower truck share but higher rail and water modal dependence. FAF^2 shows nearly no water movements, but TRANSEARCH shows 6.2 percent water in 2007, falling to 5.4 percent in 2035. FAF^2 shows a decrease in rail dependence over the period from 2007 to 2035 while TRANSEARCH shows an increase, from 4.97 percent to 5.14 percent.[22] This indicates that Massachusetts is expected to utilize rail more for goods with an origin or destination in the Commonwealth.

Trucking is the most heavily used mode, with tonnage anticipated to increase between 72 and 110 percent between 2007 and 2035.[23] The only mode that declines in percentage terms is water movements, according to the FAF^2. This data predicts water tonnage to decrease 84 percent over the period; TRANSEARCH, however, predicts an approximately 50 percent increase in water tonnage. Rail tonnage is expected to increase between 61 and 76 percent between 2007 and 2035.[24] Air tonnage is expected to see the largest growth of the modes, more than doubling according to both sources, with increases of 109 percent according to TRANSEARCH and of 117 percent according to the FAF^2.

[22] Note that rail dependence is expected to decrease when including through traffic - from 6.45% to 6.13% - though the share of freight moved by rail is larger when through traffic is included. This indicates that more freight passing through Massachusetts relies on rail, which is to be expected since rail trips are usually long-haul, bulk commodities.
[23] TRANSEARCH predicts the 72% growth, and the raw FAF^2 data (based on the data provided by the database, not based on TRANSEARCH 2007 tonnage) predicts 110%.
[24] FAF^2 predicts that tonnage will increase by 68.8% from 6.9 million to 11.6 million tons. TRANSEARCH including through traffic predicts that tonnage will increase 61% over the period, from 17.9 million tons to 28.9 million tons. Interestingly, when excluding through traffic from the TRANSEARCH database for comparison to the FAF^2 data, tonnage is expected to increase 76% from 11.2 million tons to 19.7 million tons. This indicates that much of the increase in rail tonnage can be attributed to goods with an origin or destination in Massachusetts.

4 Freight Investment Scenarios

4.1 INTRODUCTION

In order to identify freight infrastructure and operational priorities that can address the existing and future freight related issues identified in the previous chapters, a set of potential multi-modal investment scenarios were identified. These scenarios were developed with consideration of the goals of the freight system indentified in chapter one. The investment scenarios are based on significant technical analysis and stakeholder input and review; and they reflect a combination of near-term and longer-term investment options. The scenarios are intended to help meet the challenges of the following:

- **Facilitating Anticipated Growth in Goods Movement –** Despite the current economic recession, trade and goods movement is expected to continue to grow over the next 20-30 years with a projection of 70 percent growth in freight tonnage between 2007 and 2035.
- **Balancing and Diversifying the Multi-modal Freight System –** Massachusetts moves a relatively high volume share of goods by truck and relatively low share by rail, maritime, and air modes; a more diversified multi-modal system could benefit shippers and receivers of goods as well as relieve congestion on crowded highways.
- **Enhancing Economic Development Opportunities –** Freight transportation activity and freight dependent industries support employment for Massachusetts workers and a robust and more diversified economy. Additionally, preserving freight-intensive industry opportunities near market centers can lessen the truck VMT for final delivery of goods and relieve congestion.
- **Reducing Congestion and Environmental Impacts –** Infrastructure improvements that add capacity can reduce congestion for both freight and passenger travel, while shifts of future freight growth off the highway and onto the rail and water networks can result in lower environmental impacts and lower energy consumption per ton mile shipped.

The following methodology and results sections detail the development and estimation process for assessing the costs, benefits, and economic impacts of the five multi-modal investment scenarios. This includes identifying projects with the highest Return on Investment (ROI) to assist the prioritizing of near-term investment opportunities for MassDOT.

4.2 DEVELOPMENT OF INVESTMENT SCENARIOS AND PROJECT SELECTION

Each of the investment scenarios developed based on focus group sessions and public meetings and a thorough data collection, research, and analysis process. The process began with meetings with the Working Group to understand fully the capacity and other constraints for each freight transportation mode. The development and analysis of each investment scenario followed these steps:

1. Statement of goals and objectives
2. Definition of evaluation criteria
3. Identification of bottlenecks
4. Research of potential projects to alleviate constraints
5. Selection of projects using goals, objectives, and evaluation criteria
6. Grouping of projects into scenarios
7. Data collection and analysis

8. Presentation of scenarios and assembly of feedback and review by public, Working Group, and MassDOT
9. Refinement of projects and development of final scenarios

Project selection began by reviewing the existing conditions of the Massachusetts freight infrastructure. It relied heavily upon the performance measures developed to review current freight performance across all modes. Each major trade corridor was evaluated for each freight mode: highway, rail, air, and maritime. The performance measures assessment of existing conditions was compiled from a number of data sources covered in the data and collection section.

Projects were identified by the Working Group and stakeholders. Additionally, the research team compiled lists of improvement projects from a variety of existing literature and sources focusing on major freight trade corridors. Input from a panel of modal experts and public meetings were used to refine the project selection. From this, an assessment of baseline conditions of projects that will likely occur in the next 5 to 10 years was compiled.

Five investment scenarios were developed that would incorporate a range of strategic improvements. These improvements were selected to optimize and leverage the existing transportation network and planned baseline improvements. Trade strategies for moving freight by less congested or more efficient modes equally influenced project selection. A principal goal of these strategies was to divert future freight volumes from truck onto other modes.

Evaluation criteria to link to freight goals, objectives, and performance measures were utilized in the prioritization process for selecting capital infrastructure projects. The key criteria include are presented below.

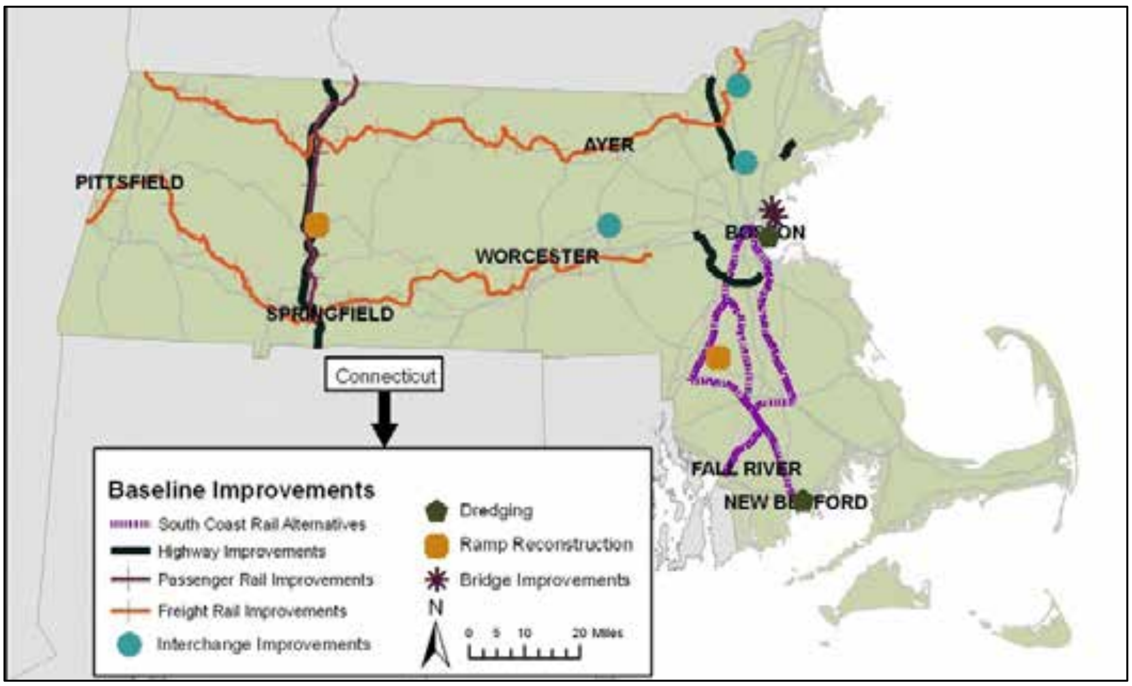
- Performance (i.e., reducing congestion and improving traffic flow)
- Operational costs
- Last mile connections to intermodal, seaport, and airport facilities
- Economic development and land use benefits (e.g., jobs and supporting smart growth)
- Environmental considerations including emissions
- Local support and consistency with transportation plans
- Safety and security
- Partnership and linkage to regional initiatives
- Funding opportunities from federal, state, local, and private sources

Assessment of the Future Baseline Conditions

To analyze any potential improvements, a future baseline condition must be established. A baseline case must identify projects that will be in place within the considered analysis period. The baseline case thus establishes an existing conditions case for the analysis period. The effects of any proposed projects or improvements can then be compared and measured against the assumed base conditions.

For the Freight Plan scenario analysis it was determined that the baseline would include the important transportation improvements either on going or planned for completion within the next 5 to 10 years. This was deemed a reasonable period of time to consider future projects within the overall evaluation period that extends to 2035. Two planned improvements that are most relevant to the freight system that are include in the baseline condition are the CSX east-west double-stack project from the New York border through Worcester to Westborough; and the Pan Am Southern Patriot Corridor 286k pound weight-on-rail upgrade. In addition to these two projects, the baseline includes dredging activities to maintain existing depths at key Massachusetts ports, MassDOT acquisition of CSX properties, highway capacity improvements on I-95 and Route 128, I-91 ITS improvements, Knowledge Corridor rail improvements on the Connecticut River Line, and the South Coast Rail Project. It also includes major interchange improvements at I-495 and I-290, I-95 and I-93 north of Boston, and I-495 at Marston Street. Ramp reconstruction projects include I-91 in Northampton and the I-495 South on-ramp from Route 40.

Figure 1: Baseline of Anticipated Massachusetts Transportation Improvements



The investment scenarios that follow have as an assumption that these baseline projects are in place and are part of the existing transportation network.

4.3 METHODOLOGY

This section presents the methodology used to assess the benefits and costs of potential freight investments in Massachusetts including the data collection, cost-benefit analysis, economic impact analysis, and key assumptions and input values.

4.3.1 DATA COLLECTION AND ANALYSIS

The following major data sources and analytical tools were gathered and examined to provide information for developing the investment scenarios and crucial data for the cost-benefit analysis.

- **TRANSEARCH Database –** Global Insight‟s TRANSEARCH database provides commodity flow data at the county level by mode. TRANSEARCH uses 2007 as a base year and provides forecasts for the years 2020 and 2035. TRANSEARCH uses the Standard Transportation Commodity Code (STCC) to categorize commodities. This includes shipments originating in Massachusetts, shipments with destinations in Massachusetts, shipments with both an origin and a destination in the Commonwealth, and shipments that solely travel through Massachusetts.

- **US Rail Desktop –** US Rail Desktop provides benchmark rail shipping rates, calculates rail mileages and carriers" costs and margins. The US Rail Desktop database was used in constructing rail shipper fees from various rail markets by major commodity types.
- **Commodity Flow Survey –** The Commodity Flow Survey (CFS) provides data on the origin and destinations, values, weights, modes of transport, distance shipped, and ton-miles of commodities shipped.[1] The CFS is a shipper-based survey conducted every five years. Data from the CFS was used to determine average haul lengths for various key commodities.
- **Producer Price Index –** The Producer Price Index (PPI) created by the Bureau of Labor Statistics, measures the average change in selling prices over time by domestic producers. The PPI was used in adjusting costs of key materials used in the construction of the investment scenarios.
- **Highway Performance Monitoring System –** The Highway Performance Monitoring System (HPMS) provides data from an inventory of highway links across all states. The data collected includes traffic volumes, speed, volume to capacity ratio, International Roughness Index (IRI), and the truck percentage. HPMS data was used to determine traffic flow and delay.
- **Central Transportation Planning Staff –** The Central Planning Transportation Staff (CTPS), staff to the Boston Region Metropolitan Planning Organization, provided 2005 base year and 2030 forecast transportation data for highway segments and key corridors for the eastern part of Massachusetts. The CTPS transportation model data included estimate for peak volumes, average speeds, volume to capacity ratio, and other key transportation metrics.
- **Freight Analysis Framework –** The Freight Analysis Framework (FAF^2) data is maintained by the Federal Highway Administration (FHWA), and forecasts freight tonnage and value in five-year increments from 2010 to 2035 for each state and the US as a whole. In addition, the FAF^2 Provisional Release data has the same 2007 commodity data available for Massachusetts. FAF^2 uses the Standardized Classification of Transported Goods (SCTG) to categorize commodities.
- **State Transportation Improvement Plans –** State Transportation Improvement Plans (STIP) are federally mandated and consist of the priority roadway, bridge, transit, and intermodal projects programmed by the Commonwealth"s ten Metropolitan Planning Organizations (MPO). The projects for the federal fiscal years 2010 through 2013 were reviewed.
- **Regional Transportation Plans –** Long-range plans of the regional planning agencies in Massachusetts were reviewed for potential freight projects and initiatives.

4.3.2 COST-BENEFIT ANALYSIS

The analytical methodology for evaluating the impacts, assessing the cost effectiveness, and creating relative comparisons involved three steps of: 1) data collection and analysis; 2) cost-benefit analysis (CBA), and 3) estimation of the economic impacts.

The CBA was developed using multiple data sources, transportation and economic models, existing study results of planned infrastructure investment, and leading expert guidance and review of all inputs and assumptions. The CBA captures economic, transportation, and

[1] BTS Commodity Flow Survey - http://www.bts.gov/publications/commodity_flow_survey/index.html

environmental benefits and costs, evaluating packages of investment projects to help create an integrated freight system. Assumptions regarding the timing and financing of investments are designed for comparison between the investment scenarios. The likely or optimal mix of private and public funding for individual projects is considered in the implementation and action plan of the Freight Plan. For the scenario evaluation, the timing of investments was held consistent across the scenarios to facilitate "apples to apples" comparisons. The CBA performed for the Freight Plan identifies the benefits and cost differences compared to baseline.

The CBA framework expresses benefits and costs monetarily in "present value" capturing the flows of benefits and cost over the project horizon. The most common metrics of a CBA are the Net Present Value (NPV) and the Benefit Cost Ratio (BCR). The NPV is the sum of the present value of future cash flows less the present value of a project"s cost including operations and maintenance expenditures. The BCR is the ratio of the benefits of a project relative to its costs, both expressed in present-value terms. A BCR above one suggests that benefits exceed costs, and the project creates a positive return on investment. CBA is a tool used to assist public and private agencies in project selection and prioritization, as described by FHWA.[2] Typical cost-benefit analysis of transportation investments measures four primary categories of benefits: travel time savings, vehicle operating costs reductions, safety improvements, and emissions reductions.

Across all five scenarios, a consistent set of assumptions regarding costs and benefits are used. Costs include initial capital investments, along with lifecycle operating and maintenance costs over the useful life of the investment. Benefits are focused on direct travel efficiency and cost savings as well as secondary benefits to environmental emissions, safety, and infrastructure conditions. All scenarios examine costs and benefits from 2010 to 2035.

The benefits evaluated in the cost-benefit analysis are:

Economic Benefits:

- Shipper cost savings are reduced freight shipping costs that result from shifts to less expensive per ton mile modes (e.g., truck to marine or rail) and/or improved service on existing routes.
- Congestion relief benefits to freight trucking occur as highways are improved or freight traffic volumes are diverted to other modes.
- Freight logistics benefits that result from improved reliability of travel times and supply chain logistics re-organization benefits for freight-dependent businesses.
- Near term jobs created during the construction period, and long term jobs created from the operation of the new investment. Although job related economic benefits occur in the Commonwealth, they are estimated separately and not included in the CBA. These economic benefits are "private benefits" as they will accrue to businesses and firms through reduced freight transportation shipping costs. This treatment ensures that the benefits identified are conservative estimates.

[2] See FHWA Guidelines for Cost-Benefit Analysis for more: http://ops.fhwa.dog.gov/freight_analysis/cba/index.htm

Transportation Benefits:

- Congestion relief benefits incurred for autos as highways are improved or freight traffic volumes are diverted to other modes.
- Highway maintenance costs are reduced in scenarios with greater freight volumes traveling by rail or marine; conversely, they are an increased cost in the truck freight improvements scenario.
- Safety benefits result from reduced accidents for scenarios with less truck VMT.
- These transportation benefits are "public benefits" as travelers will benefit from improved safety, reduced congestion, and reduced transportation costs.

Environmental Benefits:

- Emissions benefits to the environment are those that occur when freight is shipped by more energy efficient modes that produce fewer emissions per ton mile.
- Shifting to more efficient transportation modes will decrease emissions, including green house gases.
- These environmental benefits are "public benefits" as the public will benefit from improved air quality in Massachusetts and the US.

4.3.3 ECONOMIC IMPACT ANALYSIS

The economic impact analysis captures the three major types of impacts from each investment scenario. The direct, indirect and induced impacts take into account the industry effects of productivity improvements, expanded access to jobs and markets, and effects of improved reliability on business operations. The direct impacts represent the economic activity related to the initial construction and maintenance of the individual projects, for example, jobs created during the construction of bridges. The indirect impacts include the economic activity related to the supplier industries producing intermediate goods that go into the production of these investments. Lastly, the induced benefits represent the activity generated from increased labor income and additional consumption within the Massachusetts economy.

To assess the economic impacts, a Massachusetts specific Transportation Economic Development Impact System (TREDIS) multi-modal economic analysis tool was used to calculate overall impacts on the Massachusetts economy. This model estimates the benefits related to: (a) direct business responses to changes in transportation conditions and factor costs, (b) indirect effects on suppliers due to inter-industry supplier-buyer linkages, (c) induced effects generated by the recirculation of added worker wages in the local economy, and (d) other dynamic adjustments in the economy over time. The model was created to assess the freight and economic linkage between following regions of Massachusetts:

- **Berkshires –** Berkshire County
- **Pioneer Valley –** Hampshire, Hampden, and Franklin Counties
- **Central –** Worcester County
- **Greater Boston –** Suffolk, Norfolk, and Middlesex Counties
- **Northeast –** Essex County
- **Southeast –** Plymouth and Bristol Counties
- **Cape and Islands –** Barnstable and Dukes Counties

Direct transportation cost and travel time savings were allocated among industries based on goods movement within the Commonwealth of Massachusetts and analyzed at a regional level using freight origin and destination patterns within the Commonwealth. Three aspects of economic impacts are evaluated for each alternative. These include impacts from:

1. Construction spending;
2. Economic effects realized from operating and maintaining (O&M) costs of each alternative after construction is completed; and
3. Economic impacts derived from the combination of reduced shipper costs for commercial freight and time savings for existing autos and trucks.

These types of impacts are used to determine regional change in employment, output, and income. The transportation impacts used to estimate economic impacts are vehicle hours traveled (VHT) time savings and shipper cost savings. Time savings are a result of modal diversions, which increase the free-flow speed for cars, and trucks that remain on the highway. Shipper cost savings are due to reductions in transportation costs, which provide a competitive alternative to current shipment modes.

4.4 INVESTMENT SCENARIO ASSUMPTIONS

4.4.1 FREIGHT TONNAGE ESTIMATES

The freight tonnage estimates determined future freight volumes by mode. The majority of the benefit analysis is based off the freight tonnage estimates. Freight tonnage was estimated for each scenario and mode, using the following sources:

- **Tons per truckload –** Estimated using the TRANSEARCHTRANSEARCH database & FHWA Highway Design Capacity Standards;
- **Airport Tonnage –** Federal Aviation Administration “The New England Regional Airport System Plan (NERASP)” and Massport;
- **Rail Tonnage –** TRANSEARCHTRANSEARCH Database;
- **Boston Harbor Marine Tonnage –** USACOSE Feasibility Study: Deep Draft Navigation Study; and
- **Marine Tonnage –** Massport “Port Stats: Cargo Volumes at Massport Facilities.“[3]

Future freight tonnage volumes are based on the Global Insight TRANSEARCH database projections to 2035. Across all scenarios, the *total* volume of freight handled in Massachusetts is essentially the same.[4] In other words, we assume a consistent set of market-based origins and destinations as well as commodities across each scenario. The share of freight handled by each mode and the shipping route reflects the primary differences between the scenarios and the baseline conditions. For example, when evaluating a freight rail corridor improvement, the analysis includes estimates of additional freight volumes that would use that route and the corresponding decrease in volume for the alternative route. In most cases, that leads to a decrease in freight trucks traveling on relevant highway corridors. Similarly, for the port improvements, additional cargo handled at Massachusetts ports leads to less freight traveling by alternative routes and modes. For instance, it might mean less freight trucked to Massachusetts from the New York/New Jersey area.

[3] http://www.massport.com/ports/about_ports.html
[4] For the freight rail corridor improvements, the analysis included a modest potential increase in rail customers and rail shipping volumes in Massachusetts.

4.4.2 COST ASSUMPTIONS

The following represent the major capital costs categories from each scenario. Rail projects focused on increasing vertical capacity or weight on rail. Highway capital costs included increasing highway capacity through adding lanes. While port and marine cost assumptions were specific to each project and covered in the individual scenario descriptions.

Vertical Clearance for Rail

Increasing vertical clearance for bridges and tunnels to 20„8" would allow for double stack capability. The Providence and Worcester Railroad Company provided cost estimates for increasing vertical clearances.[5] The cost for the clearance for other corridors was estimated based upon similar bridge projects in the Northeast. Tunnel clearances for the corridor from Mechanicville to Maine were estimates from available per-unit cost estimates from the Heartland Corridor Clearance Improvement Project were applied to the Hoosic Tunnel and Bellows Falls. Per unit estimates for bridges were also provided by the "Springfield Terminal Railway Company Inventory of Vertical Clearances Under 21 Feet" study.

Weight-on-Rail

Increasing the weight-on-rail capacity to accommodate 286,000 lbs cars would allow for railroads to transport heavier rail cars. The incremental cost of upgrading to 286,000 lbs from 263,000 lbs capacity was estimated at $3,000 per-rail mile. The incremental operation and maintenance costs per-rail mile were estimated from "2004 Short Line Investment Act."[6] The annual O&M costs for the 286k weight-on-rail improvements follows a nine-year cycle where for the first three years no costs are incurred followed by incremental costs for years four through six and seven through nine.

Highway Capital and Operations and Maintenance Costs

Highway capital costs for new construction per lane mile were assumed to be $4.5 million based on MassDOT per-unit estimates. Highway maintenance will occur every 5 years, and estimated at $175,000 per lane mile and $75,000 per arterial lane mile. Additionally costs for constructing key arterials were estimated on a per-unit basis from equivalent existing arterial construction and operations and maintenance costs within the Commonwealth.

4.4.3 BENEFITS

The following benefit assumptions relate to the complete range of investment scenarios. The scenario analysis covers a comprehensive set of benefits that accrue to all users: public and private. Each freight project has the potential to create positive (or negative) benefits for each category of benefits, and CBA will determine whether the combined net benefits are positive or not. Each of the freight scenarios through increasing, decreasing, or shifting freight modes will affect the following benefit categories.

Congestion Relief and Travel Time Savings

Shifting freight from trucks to other modes of transportation (rail and/or maritime) reduces the amount of congestion on highway networks and results in a time savings for users that remain on the road. Congestion is measured by the change in VHT relative to existing travel conditions. Since the majority of existing traffic consists of passenger car travel, the larger

[5] Condi, P. Scott "Memorandum: Economic Stimulus – Infrastructure Programs to Support Freight Transportation and Track Estimate."
[6] 108th Congress.

share of benefits accrues to these users. Commercial trucks that remain on the road also benefit from reduced congestion, due to reductions in overall delay and improvements in reliability.

Changes in VHT were developed using data from the statewide Highway Performance Monitoring System (HPMS) Database, in combination with estimates of truck VMT reductions. Changes in truck VMT were estimated by calculating the amount of freight diverted from truck to other modes, divided by the average tonnage carried per freight truck, and then multiplied by the haul length of each shipment. Only truck shipments of lengths that could be economical by rail or maritime were considered for displacement.

The value of time estimates are generally consistent with methods for valuing user travel time benefits as followed by Center for Urban Transportation Research (CUTR) and USDOT guidance. Time savings accrue to several different "user types," since delay experienced at the vehicle level can accrue to several different parties. For example, the crew cost savings might accrue to the truck owner (carrier), the freight time cost and buffer cost savings will likely accrue entirely to the shipper, and the operating cost might be split between the shipper and carrier. More generally, costs can be accrued to: 1) households; 2) vehicle operators (carriers); 3) freight shippers (industry); and 4) non-freight business travelers (including commuters).

Value of time varies by trip purpose. An "on-the-clock" trip is a business-related passenger trip, where the traveler is compensated at the average hourly wage. Therefore, on-the-clock trips are being compensated at the driver"s hourly wage, since saving an hour on such a trip allows the business to reallocate the driver or passenger to other productive uses or eliminate the expense all together. This constitutes a true monetary savings to the business, which can be used to gain market share or reinvest. Commuter trips time savings are monetized, in accordance with US DOT,[7] as one-half of the user"s hourly wage. An hour savings of personal time constitutes a quality of life gain to the driver; this has a lower value than other purposes. The values used are shown in Table 1.

Table 1: Value of Time

Classification	Value of Time
On-the-Clock	$27.50
Commute	$21.20
Personal	$10.60

A weighted average of on-the-clock, commute, and personal value of time per hour combined with a Massachusetts specific vehicle occupancy rate of 1.1 was used to estimate the average hourly wage per passenger car trip. To estimate savings accruing to truck carriers, crew wages were drawn from the BLS National Compensation Survey (issued June 2007) (with 40 percent added for fringe benefits) resulting in a weighted average value of time of $25.02.

Shipper Costs Savings

Modal shifts reduce freight shipper costs by providing less expensive per ton-mile freight modes or through improved service on existing routes, such as truck to maritime or rail modes. In addition, diverting freight traffic from truck also alleviates congestion on highways and reduces

[7] "Value of Travel Time in Economic Analysis" US DOT.

pavement impacts of heavy vehicles. While rail and marine have lower shipper rates; however, when shippers and logistics customers balance connections, speed, reliability, and cost they often find that trucking is the most attractive option. These tradeoffs between time and costs are reflected in the ways that diverted freight traffic have been allocated by mode for each scenario.

In several of the investment scenarios increased capacity, reduced weight restrictions, and improved access accompanied by the reduced cost of shipping are the incentives for modal diversions, resulting in overall shipper cost savings. These cost savings are the results of investments in rail infrastructure that permit heavier shipments (286K weight-on-rail) and higher double-stack clearance, as well as investments to improve access, terminal expansion, dredging, and private transloading facilities at ports. Based on a combination of sources including US Rail Desktop, industry experts, and other research it was determined that the average shipper cost savings from diverting a ton-mile of freight from truck to rail is a savings of $0.04 and truck to maritime is a savings of $0.06. The difference between the modal diversion and induced volumes were used to calculate the total cost savings.

Freight Logistics Savings

Time savings or delays apply to the freight being transported, managed, and coordinated between shippers and receivers, and other logistics support. Delayed or unreliable freight shipments cause supply chain bottlenecks and often require additional labor to accommodate shipments received outside of typical delivery "windows." The inability to plan or schedule reliable freight operations throughout the logistics supply chain impose a cost on freight carriers, logistics plans, and ultimately all of the businesses that depend on the efficient operation of the freight system. This is especially true for high-value and high technology businesses that are the core of the Massachusetts economy.

The Freight Logistics savings (Table 2) is represented in this analysis as the opportunity cost of freight‟s travel time per ton, which is a weighted average of non-manufactured, non-durable and durable goods. This may be interpreted as the marginal (hourly) cost of a late delivery, or the likelihood of delivery outside of an established range of acceptable delay. Freight logistics cost is estimated on the basis of values assigned for recurring travel time delay from the Highway Economic Analysis Tool (HEAT) documentation, based on literature review and additional research by Cambridge Systematics and EDR Group.

Table 2: Freight Logistics Savings

Freight Logistics Savings	% of truck freight	$/hr/ton
Non-Manufacturing	15%	$0.75
Non-Durable Manufacturing	42%	$1.50
Durable Manufacturing	23%	$2.50
Weighted Average per Ton		**$1.32**

Accident Reduction

Safety benefits include values for property damage, personal injury, or deaths due to accidents on the transportation facility. To monetize these impacts, analysts calculate an average cost of property damage per accident, based on different travel speeds and highway geometrics, and then apply values for injuries sustained and for lives lost. The Bureau of Transportation

Statistics provided national values for the cost of accidents by type. The rate of accident occurrence for Massachusetts was determined by a ratio of accidents per 100 million VMT. These accident rates were applied to the change in VMT by mode.

Accident costs are derived from the following sources:

- Total fatality cost including both money costs and social value of lost life (lifetime earnings) is from "Treatment of the Economic Value of a Statistical Life in Departmental Analysis – 2009 Annual Revision," USDOT, Memorandum to Modal Administrators, March 18, 2009.[8]
- Detailed values for injury and property damage are drawn from Blincoe, L. et al. (2002) and The Economic Cost of Motor Vehicle Crashes, 2000 (Table 3), updated from 2000 dollars to 2008 dollars by the CPI change (25 percent).[9]

The difference between total fatality valuation and fatality cost is attributed to social valuation of lost life.

Table 3: Accident Type

	Per 100M VMT		
Accident Type	**Car**	**Truck**	**$ per Accident**
Property Damage	206	198	$3,160
Personal Injury	90	12	$83,520
Fatality	1.5	0.4	$6,000,000

Reduced Highway Maintenance Cost

Diverting freight from trucks to either rail or marine modes reduces the number of trucks on the highways that affects both congestion and highway maintenance costs. Truck traffic on highways deteriorates highway surfaces and increase overall highway maintenance costs. Several of the scenarios forecast a significant diversion of truck freight to other modes, which is included in the benefit costs analysis. The average reduction in highway maintenance cost per truck VMT is estimated at $0.18.[10]

Environmental Benefits

Freight diversions from one mode to another can result in changes in overall emissions attributable to freight movements. Table 4 below highlights the pollutant types by modes based on the EPA Mobile 6 emission rates (grams per mile). The economic value of these emission reductions were calculated using tradable allowance prices from Cantor C02[11] and Victoria Transportation Planning Institute (VPTI). A growth rate of 3 percent was applied to the market price through 2035. Rail produces far less pollutants per mile than truck, and therefore diverting freight from truck to rail reduces emissions.

8 http://ostpxweb.dot.gov/policy/reports/VSL%20Guidance%20031809%20a.pdf
9 http://thedesignstate.com/wp-content/uploads/2009/04/economicimpact2000.pdf
10 "Federal Highway Cost Allocation Study" FHWA 1997.
11 http://www.cantorco2e.com

Table 4: Emissions by Mode in Grams per Mile, 2030

		2030 (Grams)				
Mode	**Measurement**	**VOC**	**NOx**	**CO**	**CO2**	**PM**
Truck	Grams per truck mile	0.21	0.68	0.21	64.20	0.07
Rail	Grams per rail carload	0.02	0.29	0.07	19.82	0.01
Car	Grams per car mile	0.29	0.21	8.36	415	0.02

Emission benefits are measured as the difference in emission costs per ton-mile for freight diverted from truck to rail. Since rail produces fewer emissions per mile, the diversion produces a benefit of reduced emissions. Emission rates used were from the Environmental Protection Agency values for grams per mile of emission, and were converted to a dollar value based on Victoria Transportation Policy Institute‟s and FHWA‟s HERS values of dollars per ton of emission. The emissions benefits were monetized using USDOT TIGER Grant guidelines, representing the benefits of cleaner air and the cost of mitigation. The following cost estimates in Table 5 were used in developing emissions estimates per ton-mile of freight, which were applied to the incremental changes in ton-miles per mode. Additionally the emissions cost per million ton-miles by mode is shown below Table 5. Emissions benefits that would occur outside of Massachusetts due improvements within the Commonwealth were captured.

Table 5: Economic Costs per Ton of Pollutant and Cost per Million Ton-miles

	2030				
Measurement	**VOC**	**NOx**	**CO**	**CO2**	**PM**
Cost per ton of pollutant	$1,860	$1,213	$116	$34	$1,745

	Cost Per Million Ton Miles 2030	
	Truck	**Rail**
VOC	$29.35	$0.80
NOx	$60.94	$9.19
CO	$1.84	$0.20
CO2	$161.32	$17.28
PM	$8.69	$0.45

Mode Shift Assumptions

Mode shifts for the scenario analyses focused on freight tonnage shifts from truck to rail and truck to marine. By shifting freight from truck to alternative modes would reduce truck travel on the highways and provide a reduction in congestion, GHG emissions, and accidents. The shift in freight was estimated on a project by project basis using the TRANSEARCH database, available freight transportation research, existing studies and plans for specific projects, and the team‟s modal experts. The research team was able to estimate the existing freight conditions on each route and determine the new tonnage that would travel that route following the improvements. The team estimated diverted freight and induced tonnage based upon the origin and destination patterns of freight and the distance traveled. Diverted freight for individual projects ranged from a 10 percent to 30 percent increase from baseline freight volumes.

4.5 INVESTMENT SCENARIOS

All scenarios examine a consistent set of costs and benefits from 2010 to 2035. Scenarios were developed through research, interviews with transportation logistics experts, public outreach, and an assessment of the Commonwealth"s transportation bottlenecks. The research team compiled lists of improvement projects from a variety of existing literature including but not limited to: state transportation improvement plans (STIP), harbor master plans, and infrastructure needs assessments. Evaluation criteria were utilized to link to freight goals, objectives, and performance measures in the prioritization process for selecting capital infrastructure projects. Projects were organized and packaged together into scenarios by key corridors and intermodal connections to strategically improve and enhance the existing freight system. The five freight investment scenarios assessed in this Freight Plan are:

1. **Truck Freight Improvements –** Recognizing the continued prevalence of truck and highway-oriented goods movement, the final scenario examines major highway capacity expansions throughout the Commonwealth, primarily on the Interstate system, to address growth in freight truck activity along key corridors.
2. **Northern Tier Rail Improvements –** This scenario provides enhanced freight rail corridor connections from the New York border to Ayer, and from Ayer to New Hampshire with emphasis on weight on rail (286k) and double-stack capability, along with supporting improvements to intermodal facilities in Ayer, and rail connections to Worcester and Springfield. This scenario assumes complementary improvements in New Hampshire to allow double-stack rail traffic to travel along the corridor from New York through to Maine. The scenario captures only the cost of improvements within Massachusetts.
3. **South Coast Multi-Modal Freight Improvements –** This scenario examines improvements to port, rail, transload and highway facilities in Southeastern Massachusetts. Specific improvements are targeted at the Fall River and New Bedford ports to handle increased cargo throughput, with coordinated investment in truck and rail access to/from the ports, 286k weight on rail from the CSX main line from Framingham to Fall River and New Bedford, and a new transload facility in the region.
4. **Central and Western MA Rail Improvements –** This scenario focuses on double-stack and weight on rail north-south rail linkages on Pioneer Valley, New England Central, Pan Am Southern, and Providence and Worcester railroad corridors, in addition to improved truck access to intermodal and aviation facilities, and a full-service truck stop.
5. **Boston Core Multi-Modal Freight Improvements –** This scenario concentrates on facilitating goods movement distribution in Boston with connections to the Interstate system, and focused improvements to the Port of Boston. In particular, this scenario includes a major channel deepening project in Boston with supporting truck and rail access improvements.

4.6 INVESTMENT SCENARIO ANALYSIS RESULTS

The detailed CBA and economic impacts of each scenario are presented in this section followed by the economic impact results from construction and operations and maintenance investments for each scenario.

4.6.1 TRUCK FREIGHT IMPROVEMENTS

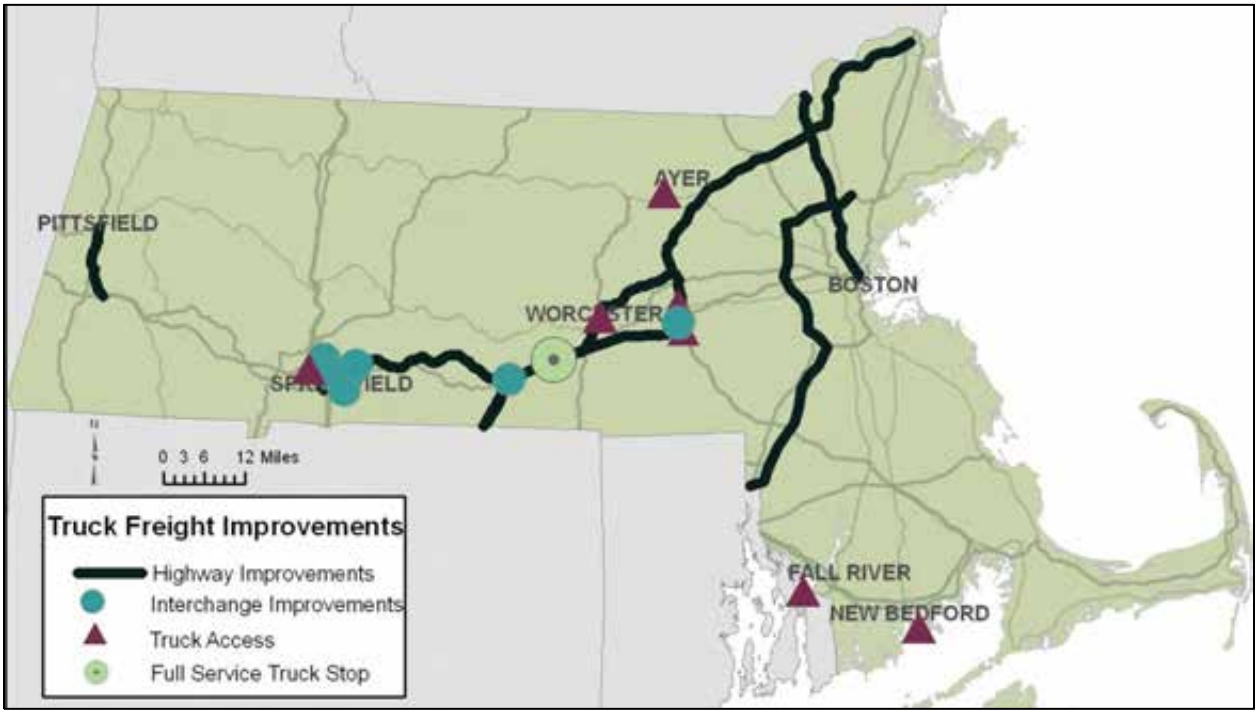
Recognizing the continued prevalence of truck and highway-oriented goods movement, the Truck Freight Improvements scenario focuses on major highway capacity investments throughout the Commonwealth, primarily on the Interstate system to accommodate growth in freight truck activity along key corridors. The Truck Freight Improvements scenario differs from other scenarios since the focus is on increasing capacity of the current highway system instead of providing alternative modal improvements in an attempt to induce freight diversions to other modes. Over the time horizon of the analysis period (2035), additional growth and induced trips are factored into the analysis. This scenario is intended to some degree as a “control” scenario that tests the costs and benefits of attempting to accommodate growth strictly by responding to truck demand, rather than trying to facilitate freight mode shifts.

The Truck Freight Improvements is a scenario that is designed to test the costs, benefits, and impacts of an approach to freight investment that relies on the highway capacity improvements that would be necessary to significantly relieve highway congestion on the major freight corridors of the state. It is intended as a “what if” highway only based scenario. It is important to note that the elements of the truck mode optimization contain planned projects and changes to the highway system that are not planned and therefore should not be viewed as a recommended built-out plan.

The capacity improvements are targeted at the highest freight volume corridors and thus are concentrated on major Interstate facilities such as I-90, I-84, I-290, I-495, I-95, and I-93. In addition, there are supporting investments to improve key interchanges that are considered bottlenecks, sometimes with sub-standard operations (e.g., I-291 and I-90 in Chicopee), along with truck access improvements to freight railyards and seaports. Improvements to the interchanges consist of lengthening and widening ramps, rebuilding bridges and reconstructing toll plazas. The map below indicates the assumed lane additions on key freight highway corridors. Improvements to Route 20 will include the addition of one lane in each direction and a truck climbing lane.

Assuming very aggressive implementation schedules for these major projects, these improvement projects are assumed to be constructed and completed from 2014 to 2024. The total capital costs of this scenario are approximately $7.3 billion ($4.7 billion in present value).

Figure 2: Truck Freight Improvements Scenario



Cost-Benefit Analysis

The Truck Freight Improvements scenario is estimated to cost $4.7B with 87 percent of fund dedicated to highway capacity enhancement, and the remaining 13 percent for interchange re-construction.

Table 6 presents the present value of the capital and operating and maintenance (O&M) costs cumulative through 2035. The Truck Freight Improvements scenario is by far the most costly scenario, and not consistent with MassDOT‟s GreenDOT and other state policies that promote smart growth and reduced GHG emissions. This scenario represents a "what if" case where freight improvements were limited to highway infrastructure.

Table 6: Truck Freight Improvements Scenario Costs ($Millions)

PV of Total Costs	Construction	O&M
$4,902.40	$4,763.60	$136.60

The benefits of this scenario depends on the time savings provided for all users due to increased speeds attributable to greater capacity, and an increase in the reliability of highway travel due to a reduction in delays. By 2035 over 48.1 million VHT are saved by automobiles and 4.1M VHT for commercial freight carriers. Freight logistics cost savings, totaling $74M, are also classified as benefits for this scenario. Annual growth and induced trips add to the current volume on the highway network that produces "dis-benefits" attributable to additional accidents, higher highway maintenance costs, and increases in vehicle emissions. A list of the benefits (positive sign) and "dis-benefits" (negative sign) are provided in Table 7 below.

Table 7: Truck Freight Improvements Scenario Benefits ($Millions)

PV of Total Benefits	Accidents	Highway Maintenance	Shipper Benefits	Congestion Reduction	Net Emissions
$5,082.80	($61.50)	($212.80)	$0.00	$5,551.10	($194.00)

The primary transportation performance impact of significantly increasing highway capacity is congestion relief and a reduction in travel time delay, estimated in terms of reduced VHT. Of note, even while these improvements are targeted at the largest freight flows on the system, these facilities still carry far more autos than trucks (Table 8) and thus the reduction in VHT is almost 12 times greater. Another notable expected impact is induced highway traffic as experience and research shows that adding new capacity tends to draw additional travel. This means increases in truck and auto VMT, which has mitigating effects in terms of emissions, pavement damage, accidents, and travel speed.

Table 8: Estimated Annual Transportation Benefits, 2035

Transportation Benefit	
Reduced Truck VHT	4.2 million/year
Reduced Auto VHT	48.2 million/year
Increased Truck VMT	54.1 million/year
Increased Auto VMT	599.5 million/year

Source: HDR calculations

This scenario is by far the most expensive of the five investment strategies even with applying the discount rates. On the other hand, the improvements do provide congestion relief on some of the Commonwealth"s most traveled highway corridors and thus are estimated to generate the largest total benefits at $5 billion. The estimated benefit-cost ratio is 1.04, which is barely above 1.0. Most of the benefits are related to congestion relief (see Table 9) to autos and trucks, including induced traffic, and freight logistics However, the challenges such as environmental permitting, litigation, available transportation funding, and other issues of these projects were excluded from the analysis.

There are also negative benefits (or costs) related to higher VMT, such as $212.8 million in pavement maintenance and repair costs, $194 million in emissions costs (i.e., greater greenhouse gas emissions), and $61.5 million in accident costs. The transportation and environmental component are 80 percent of the net benefits.

Table 9: Truck Freight Improvements Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	N/A
Truck Congestion Relief Benefits	$607.10
Freight Logistics Benefits	$433.00
Economic Benefits & Cost Savings	**$1,040.10**
Auto Congestion Relief Benefits	$4,510.90
Reduced Emissions	($194.00)
Reduced Accidents	($61.50)
Reduced Highway Maintenance and Repair	($212.80)
Transportation & Environmental	**$4,042.60**
TOTAL BENEFITS	**$5,082.70**
Capital Costs	$4,763.60
O&M Costs	$136.60
TOTAL COSTS	**$4,900.20**
Net Present Value (NPV)	**$182.60**
Benefit-Cost Ratio	**1.04**

Source: HDR and EDR Group calculations

Economic Impact

Congestion reduction which includes the monetary value of time saved (crews, passengers, and freight) provide the largest source of cost savings of the scenario. These cost savings (See Table 10) total $891.6M in 2035.

Table 10: Direct Cost Savings ($Millions)

Economic Impacts In 2035 (2008$)	In-State Cost Savings
Shippers and Receivers	$431.5
Cost Savings to Vehicle Operator	$78.6
Household Value of Time Benefit	$381.4
Total	**$891.6**

The $510.1M in direct savings for shippers/receivers and vehicle operators produces indirect and induced economic effects resulting in $583.5M in total business output in 2035 and $6.3B for all years. This level of economic activity will produce over 46,000 jobs and $2.3B in wages, as listed in Table 11 for 2010-2035 timeframe.

Table 11: Total Operational Impacts

	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
Operational Impact (all years)	$6,313.9	$3,348.1	2,475*	$2,345.3
Operational Impact (2035)	$583.5	$309.4	4,282	$216.7

*Denotes average annual jobs over operational period

Since the effects of highway improvements affect a broader spectrum of businesses (Table 12), and because there are no diversions required for businesses to take advantage of improvements in highway capacity and reliability, the effects in various industrial sectors is more broad-based than in other scenarios.

Table 12: Operational Impacts by Industry Sector

Major Economic Sectors	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wages ($Mil)
Agriculture, Mining and Utilities	$12.30	$6.70	85	$2.20
Construction	$9.20	$4.70	61	$4.00
Manufacturing	$149.10	$46.40	373	$31.70
Trade and Transportation	$129.60	$75.40	1,066	$49.30
Financial Services, Real Estate	$36.80	$23.60	146	$11.00
Professional and Information Services	$89.20	$54.00	687	$44.90
Education and Health Services	$73.30	$45.50	801	$40.50
Leisure and Hospitality	$51.00	$28.00	794	$19.10
Government	$22.00	$19.10	142	$9.50
Other	$11.10	$5.90	126	$4.50
Total	**$583.50**	**$309.40**	**4,281**	**$216.70**

While the analysis from this scenario suggests large impacts, these impacts come at a cost. As the cost-benefit analysis shows, the largest portion of benefits accrue to passenger vehicles rather than the freight system, while increasing emissions, accidents, and highway maintenance and repair. The consequences of such a series of highway investments would likely facilitate further urban sprawl, which is contrary to the Commonwealth‟s smart growth and GHG reduction policies. This scenario therefore illustrates the costs of large-scale highway based investments for comparison purposes, but these investments are not recommended as freight improvements.

4.6.2 NORTHERN TIER RAIL IMPROVEMENTS

The Northern Tier rail improvements scenario provides enhanced freight rail corridor connections from the New York border to Ayer, and from Ayer to New Hampshire. This scenario puts an emphasis on weight-on-rail (286k) and double-stack capability, along with supporting improvements to intermodal facilities in Ayer, and rail connections to Worcester and Springfield. The specific investments included in this scenario are:

- 286k weight-on-rail upgrades to rail corridors (Worcester to Ayer and Worcester to Gardener) connecting to and from the Patriot Corridor, which is planned for a near-term 286k weight-on-rail upgrade;
- Double-stack clearance from Mechanicville, NY to New Hampshire via the Patriot Corridor; and
- Enhanced intermodal facility in Ayer to facilitate truck-rail transfers of containers.

These projects are anticipated to be constructed between 2010 and 2014 at a cost of approximately $100.6 million ($89.4 in present value terms).

Figure 3: Northern Tier Rail Improvements Scenario

Cost-Benefit Analysis

The Northern Tier Rail Improvements scenario is expected to cost over $100M with 39 percent allocated to double stack (D/S) and 61 percent allocated to 286K weight-on-rail improvements. Of the seven planned projects in this scenario, 77 percent is allocated among three projects: the Mechanicville to Ayer line-D/S (34 percent), the Ayer to New Hampshire line-286k weight-on-rail (24 percent), and the Deerfield to Springfield line- 286k weight-on-rail (20 percent). The Operations and Maintenance (O&M) for the Double Stack improvements range from $9,000 per year to $37,500 per year and scheduled to occur on an annual basis through 2035. The annual O&M costs for the 286k weight-on-rail improvements range from $34,500 to $120,000 and follows a nine-year cycle where for the first three years no costs are incurred followed by incremental costs for years four through six and seven through nine. The present value of the capital and O&M costs cumulative through 2035 are shown in Table 13 for the Northern Tier rail improvements scenario.

Table 13: Northern Tier Rail Improvements Scenario Costs ($Millions)

PV of Total Costs	Construction	O&M
$93.20	$89.40	$3.80

The focus of the Northern Tier rail improvements scenario is to strengthen the dominant east-west rail infrastructure in order to increase both weight and volume capacity which will decrease the overall cost of shipping. Under this scenario, there will be an increase of 1.5M metric tons of freight diverted from truck to rail (Table 14) as companies take advantage of the shipping cost differential.

In addition to the shipper cost savings, diverting truck shipments to rail reduces congestion on the highway and provides time savings to remaining trucks and cars on the highway. With more commercial traffic capacity and a reduction of congestion, the expected accident costs, emissions, and other associated costs are reduced. Reducing truck traffic also reduces highway maintenance costs and overall emissions. Table 15 displays the aggregate benefits.

Table 14: Estimated Annual Transportation Benefits, 2035

Transportation Benefit	
IM Freight Rail Volumes (Truck to Rail)	30% increase, 504,000 tons/year
Rail Carloads (Truck to Rail)	9% increase, 387,000 tons/year
Induced Freight Rail Customer Shipping	585,000 tons/year (IM and Carload)
Reduced Truck VMT	6.2 million VMT in MA, 59.4 million VMT in US

Source: HDR calculations

Table 15: Northern Tier Rail Improvements Scenario Benefits ($Millions)

PV of Total Benefits	Accidents	Highway Maintenance	Shipper Benefits	Congestion Reduction	Net Emissions
$347.9	$2.8	$9.4	$315.26	$18.6	$1.8

Direct transportation benefits include about 500,000 additional tons of intermodal (IM) tonnage carried by rail, and almost 1 million tons of rail carloads. These transportation benefits lead to a reduction in shipping costs to Massachusetts and external shippers, as well as public benefits due to reduced truck VMT as shown in the summary of cost-benefit results (all in 2009 present value dollars). For this scenario, the NPV is almost $255 million over the forecast time period (Table 16) and the benefit-cost ratio is estimated to be 3.7. That means that each dollar of investment returns $3.70 in benefit to Massachusetts as well as shippers and receivers regionally and nationally. The largest category of benefits in this scenario relate to reduced shipping costs as increased use of freight rail for goods movement results in lower per ton mile costs to businesses. The second largest category of benefits is for congestion relief to autos (and trucks) as more future freight growth is carried by the rail system, resulting in improved highway performance. As estimated, 8.3 percent of benefits are directly related to transportation and environmental with another 91.7 percent of benefits are due to cost savings and other economic benefits.

Table 16: Northern Tier Rail Improvements Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$315.20
Truck Congestion Relief Benefits	$2.20
Freight Logistics Benefits	$1.60
Economic Benefits & Cost Savings	**$319.00**
Auto Congestion Relief Benefits	$14.90
Reduced Emissions	$1.80
Reduced Accidents	$2.80
Reduced Highway Maintenance and Repair	$9.40
Transportation & Environmental	**$28.90**
TOTAL BENEFITS	**$347.90**
Capital Costs	$89.40
O&M Costs	$3.80
TOTAL COSTS	**$93.20**
Net Present Value (NPV)	**$254.70**
Benefit-Cost Ratio	**3.7**

Source: HDR and EDR Group calculations

Economic Impact

The monetary value of time saved (crews, passengers, and freight) due to congestion reduction and the amount saved by switching to lower cost shipping modes are both classified as cost savings for shippers and others that drive on the highway (e.g. employees on-the-clock, commuters, and personal). These cost savings account for $9.5M in savings by 2035.

The portion of the savings that accrue to shippers and vehicle operators are likely to be spent on either improved production capacity or other productivity enhancements. These vary by industry, but generally contribute to overall economic output. These savings, if coupled with productivity and increased output, often result in additional purchases from suppliers that represent “indirect” impacts. The wage effects in both the primary and secondary supplier industries, these wages are re-spent, producing additional “induced” impacts.

The $8.6M that commercial shippers, receivers, and vehicle operators save is estimated to be spent on internal productivity enhancements or expansion of output which, through indirect and induced impacts, result in an increase of $22.9M in total business output by 2035 and $258.7M for all years covered in the analysis period. This output results in the creation of 1,087 jobs and $68.4M in wages (Table 17) for 2010-2035 timeframe.

Table 17: Total Operational Impacts

Northern Tier Rail Improvements Scenario	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
Operational Impact (all years)	$258.7	$106.80	45*	$68.4
Operational Impact (2035)	$22.9	$9.50	96	$6.1

*Denotes average annual jobs over operational period

Industries that ship a large portion of their commodities on the rail network in the Northern Tier Rail Improvements scenario and their corresponding suppliers are the sectors that experience the greatest economic impacts. These industries are predominantly manufacturing, and trade and transportation. The secondary effects of these savings, as they work their way through the Massachusetts economy, accrue to professional & information services and financial services industries. Both worker and business spending increase demand for services produced by the Educational and Health Services, and the Leisure and Hospitality industries. These operational impacts in Table 18 are reflective of expected results in 2035.

Table 18: Operational Impacts by Industry Sector

Major Economic Sectors	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wages ($Mil)
Agriculture, Mining and Utilities	$0.60	$0.30	3	$0.10
Construction	$0.10	$0.10	1	$0.00
Manufacturing	$14.70	$4.30	34	$2.70
Trade and Transportation	$2.40	$1.50	17	$0.90
Financial Services, Real Estate	$1.00	$0.60	3	$0.30
Professional and Information Services	$1.80	$1.10	11	$0.90
Education and Health Services	$0.90	$0.50	9	$0.50
Leisure and Hospitality	$0.50	$0.30	8	$0.20
Government	$0.70	$0.60	5	$0.30
Other	$0.30	$0.20	3	$0.10
Total	**$22.90**	**$9.50**	**94**	**$6.10**

Once rail infrastructure improvements have been made, there is a “ramping up” period as shippers begin to respond to the cost advantages of diverting freight to rail which increases significantly through 2035. These cost savings are the catalyst to drive further economic impacts to the region. This progressive adoption of cost savings has been accounted for in the total economic effects estimated in Table 19, and reflects the time it may take for businesses to adapt their logistics infrastructure to take advantage of greater rail capacity. A more rapid uptake will increase the net economic impacts to the Commonwealth, thereby, making the estimates provided in this analysis somewhat “conservative” in that they are lower than might occur with faster adaptation by businesses and shippers.

Table 19: Operational Impacts by Year

	TOTAL OPERATIONAL IMPACTS - BY YEAR			
Year	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
2010	$0.00	$0.00	0	$0.00
2015	$3.60	$1.50	15	$0.90
2020	$7.20	$3.00	30	$1.90
2025	$11.60	$4.80	49	$3.10
2030	$16.80	$6.90	70	$4.40
2035	$22.90	$9.50	96	$6.10

Cost-Effective Investments Based on Preliminary Analysis

While the focus of this analysis is on the entire investment scenario, preliminary analyses of the individual projects that comprise the scenario provide some indication of the relative benefits of each investment opportunity. For the Northern Tier rail improvements scenario, project investments that are estimated to provide the greatest long-term return on investment include:

- Providing double-stack clearance from Mechanicville, NY to Ayer and then to New Hampshire, as well as linking Ayer to Worcester to facilitate greater double-stack network connections for intermodal containers within Massachusetts and beyond. Capital costs for these improvements are estimated to be $39.4 million, with over $30 million of that for the Mechanicville to Ayer segment that includes the Hoosic Tunnel.
- Extending 286k weight-on-rail capacity connections from the Patriot Corridor from Ayer to New Hampshire and from Ayer to Worcester. Capital costs for these improvements are estimated to be just over $30 million with about $7 million for the Ayer-Worcester project.

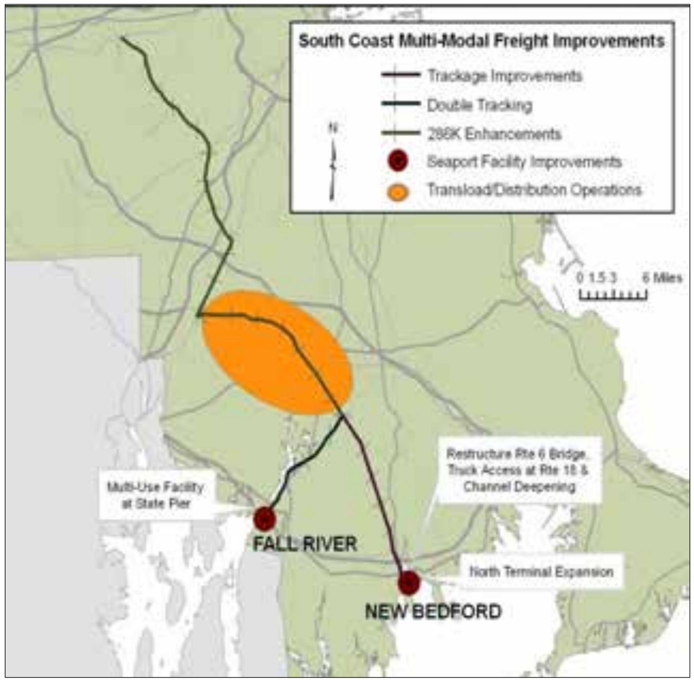
4.6.3 SOUTH COAST MULTI-MODAL FREIGHT IMPROVEMENTS

The South Coast Multi-Modal Freight Improvements scenario examines improvements to port, rail, transload and highway facilities in Southeastern Massachusetts. Specific improvements are targeted at the Fall River and New Bedford ports to handle increased cargo throughput, with coordinated investment in truck and rail access to/from the ports, 286k weight-on-rail from the CSX main line through the region, and a new private inland transload facility located in Southeastern Massachusetts. The individual investments include:

- Marine terminal facility improvements at the Fall River State Pier and expansion of the New Bedford North Terminal;
- Accelerating and expanding Navigational dredging projects in New Bedford;
- Improved truck access to New Bedford via Rt. 18 and JFK Highway improvements and improving the Rt. 6 bridge to allow larger ships access to the North Terminal;
- 286k weight-on-rail capacity enhancements from the CSX main line south to the Taunton area and other track improvements to Fall River and New Bedford (with timing coordinated with the South Coast Rail project); and
- Expanded inland transload and distribution center operations in the region to handle, warehouse, and exchange goods between rail and truck.

These projects are anticipated to be constructed between 2010 and 2018 at a capital cost of approximately $158 million ($126.5 in present value terms), not including O&M costs.

Figure 4: South Cost Multi-Modal Freight Improvements Scenarios



Cost-Benefit Analysis

The South Coast Multi-Modal Freight Improvements scenario is estimated to cost $159M with the funding applied to the following project categories: 35 percent terminal and pier expansion, 23 percent dredging, 20 percent truck access, 13 percent 286K weight-on-rail improvements, and 9 percent for the transload facility. The O&M cost differs for each of the projects. The O&M for terminal and pier projects require a constant expenditure of funds in a five-year cycle. For dredging, the baseline scenario includes funding for maintenance of both Fall River and New Bedford harbors, and therefore was not included in this scenario. Truck access projects and the transload center follow a six year cycle. Maintenance of the 286k weight-on-rail line ranges from $16,500 to $189,000 , or $3,000 per rail mile, and follows a nine year cycle where for the first three years no costs are incurred followed by incremental costs for years four through six and seven through nine. The cumulative capital and O&M costs are presented in Table 20 in present value terms through 2035.

Table 20: South Coast Multi-Modal Freight Improvements Costs ($Millions)

PV of Total Costs	Construction	O&M
$93.20	$89.40	$3.80

With plans for additional cargo handling capacity at the ports of Fall River and New Bedford and a strengthened infrastructure for truck and rail access, shippers are expected to use higher levels of maritime and rail modes of shipment. Cost savings for bulk and non-time sensitive commodities will provide an incentive for shippers to use the Southeastern ports instead of using other port alternatives (e.g. Port of NY/NJ, Boston, Providence, etc) and completing the final leg of the haul in Massachusetts and other locations in New England by truck. Second, shippers are also expected to increasingly use rail service and the proposed intermodal facilities to transport their freight to and from the New Bedford and Fall River ports instead of relying on truck shipments. Third, because of the increased weight-on-rail capacity, shippers will benefit by increasing returns to scale through lower shipping costs for existing shipments. These three sources of shipper cost savings are expected to divert over 1.7M metric tons of freight from truck to vessel and rail.

As in other scenarios, diversion of truck shipments will result in increasing the available highway capacity for trucks and passenger cars. The accumulated effects of these savings are listed in Table 21 for multimodal improvements in Southeastern Massachusetts.

Table 21: South Coast Multi-Modal Freight Improvements Benefits ($Millions)

PV of Total Benefits	Accidents	Highway Maintenance	Shipper Benefits	Congestion Reduction	Net Emissions
$135.40	$3.20	$10.80	$100.90	$19.70	$0.80

Transportation impacts due to these improvements are expected to lead to greater marine cargo shipping to Fall River and New Bedford, as the ports can leverage better facilities and landside connections to capture future growth in short-sea and coastal shipping. This leads to both shipping costs benefits on a per ton mile basis compared to trucking the full distance, as well as reduced truck VMT. The analysis explicitly considered alternative shipping patterns if these improvements are not made, such as increased freight volumes that would enter the Massachusetts market via ports in New York/New Jersey or Halifax that are then trucked to the region. The 286k weight-on-rail improvements are also expected to lead to some increased future goods movement by rail, though it should be noted that even with the gains shown in Table 22 below, the vast majority of freight is still expected to be shipped by truck.

Table 22: Estimated Transportation Benefits, 2035

Transportation Benefit	
Increased Marine Cargo Throughput	105% increase, 883,900 tons/year
Rail Carloads (Truck to Rail)	45% increase, 830,000 tons/year
Induced Freight Rail Customer Shipping	184,600 tons/year (Carload)
Reduced Truck VMT	7.8 million VMT in MA, 21.6 million VMT in US

Source: HDR calculations

For this scenario, the estimated NPV is a gain of $4.3 million, meaning that benefits exceed cost over the forecast time period, and the benefit-cost ratio is estimated at 1.03. The largest benefits include over $100.9 million in shipper cost savings and $10.8 million in reduced highway maintenance. Highway congestion relief to autos (and trucks) from the local roadway improvements is an important benefit as more future freight growth is carried by the marine and rail systems, resulting in less truck VMT and improved highway performance. As estimated, 81 percent of benefits are cost savings from reduced truck highway congestion, freight logistics benefits, and a reduction in shipper costs.

Table 23: South Coast Multi-Modal Freight Improvements Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$100.9
Truck Congestion Relief Benefits	$5.2
Freight Logistics Benefits	$3.8
Economic Benefits & Cost Savings	**$110.0**
Auto Congestion Relief Benefits	$10.7
Reduced Emissions	$0.7
Reduced Accidents	$3.2
Reduced Highway Maintenance and Repair	$10.8
Transportation & Environmental	**$25.4**
TOTAL BENEFITS	**$135.4**
Capital Costs	$126.6
O&M Costs	$4.5
TOTAL COSTS	**$131.1**
Net Present Value (NPV)	**$4.3**
Benefit-Cost Ratio	**1.03**

Source: HDR and EDR Group calculations

Economic Impact

Congestion reduction and shipper costs savings for this scenario involve the value of time saved (crews, passengers, and freight) due to congestion reduction and the savings to industry by switching to lower cost shipping modes. Both are classified as cost savings for shippers and highway users, such as employees on-the-clock, commuters, and those on personal travel. These cost savings account for $5.7M in savings in 2035.

Table 24: Direct Cost Savings ($Millions)

Cost Saving Categories (2035)	In-State Cost Savings
Shippers and Receivers	$4.00
Cost Savings to Vehicle Operator	$1.00
Household Value of Time Benefit	$0.70
Total	**$5.70**

Savings that accrue to shippers and vehicle operators and spent on improved productivity increase output and improve market share, contributing to overall economic output. The $5M in direct savings to commercial shippers/receivers and vehicle operators produces $10.9M in total business output by 2035 and $126.3M for all years. This output would result, as shown in Table 25, in the creation of 578 jobs and $35.1M in wages for the 2010-2035 timeframe. The $0.7M that households gain from time saved in this scenario is considered to be an overall benefit but since no actual monetary transactions occur, these savings are is not included in estimating economic impacts.

Table 25: Total Operational Impacts

	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
Operational Impact (all years)	$126.30	$54.00	28*	$35.10
Operational Impact (2035)	$10.90	$4.70	50	$3.10

*Denotes average annual jobs over operational period

Industries that would likely ship a large portion of their commodities through the Fall River and New Bedford ports in the South Coast Multi-Modal Freight Improvements scenario and their corresponding suppliers will experience the greatest economic impacts. Similar to the Northern Tier Rail Improvements scenario, industries most influenced by these changes, as indicated in Table 26, are manufacturing, trade & transportation, professional & information services and education and health services.

Table 26: Operational Impacts by Industry Sector

Major Economic Sectors	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wages ($Mil)
Agriculture, Mining and Utilities	$0.30	$0.20	2	$0.00
Construction	$0.10	$0.00	-	$0.00
Manufacturing	$6.30	$1.90	14	$1.20
Trade and Transportation	$1.60	$0.90	12	$0.60
Financial Services, Real Estate	$0.50	$0.30	2	$0.20
Professional and Information Services	$0.90	$0.50	6	$0.50
Education and Health Services	$0.50	$0.30	5	$0.30
Leisure and Hospitality	$0.30	$0.10	4	$0.10
Government	$0.30	$0.30	2	$0.10
Other	$0.20	$0.10	2	$0.10
Total	**$10.90**	**$4.70**	**49**	**$3.00**

With the infrastructure improvements in place, the incentive to divert freight from truck and rail will change how shippers do business. Cost savings is the catalyst driving further economic impact to the region as Table 27 indicates.

Table 27: Operational Impacts by Year

	TOTAL OPERATIONAL IMPACTS - BY YEAR			
Year	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
2010	$0.00	$0.00	0	$0.00
2015	$1.90	$0.80	9	$0.50
2020	$3.60	$1.50	17	$1.00
2025	$5.70	$2.40	26	$1.60
2030	$8.10	$3.50	37	$2.20
2035	$10.90	$4.70	50	$3.00

Project improvements were concentrated in the Southeast region. However, economic impacts were allocated to other regions based on rail and truck origin and destination patterns, which indicate that employment impacts are concentrated in the Pioneer Valley, Central, and Greater Boston regions.

Cost-Effective Investments Based on Preliminary Analysis

As this is truly an integrated multi-modal freight improvement scenario for Southeastern Massachusetts, it can be difficult to separate the effects of individual projects within the broader investment package. That said, the project initiatives in the South Coast Multi-Modal Freight Improvements scenario that indicate a high return on investment include:

- Upgrading the rail corridor from Framingham on the CSX Main Line to the region‟s core, with coordinated track improvements to Fall River and New Bedford to allow effective shared use rail connections to the ports. These rail improvements are estimated to cost approximately $20 million beyond the money spent on the South Coast Rail project.
- The New Bedford North Terminal expansion project with associated port improvements (dredging, bridge clearance) is estimated to cost $55 million with 7,370 tons of cargo annually per $1 million in investment and a positive return on investment.
  It should also be noted that supporting projects, such as a transload facility in the region, navigational dredging projects, and highway access improvements to New Bedford, might be necessary to achieve the marine cargo shipping market gains estimated in this scenario.

4.6.4 CENTRAL AND WESTERN MA RAIL IMPROVEMENTS

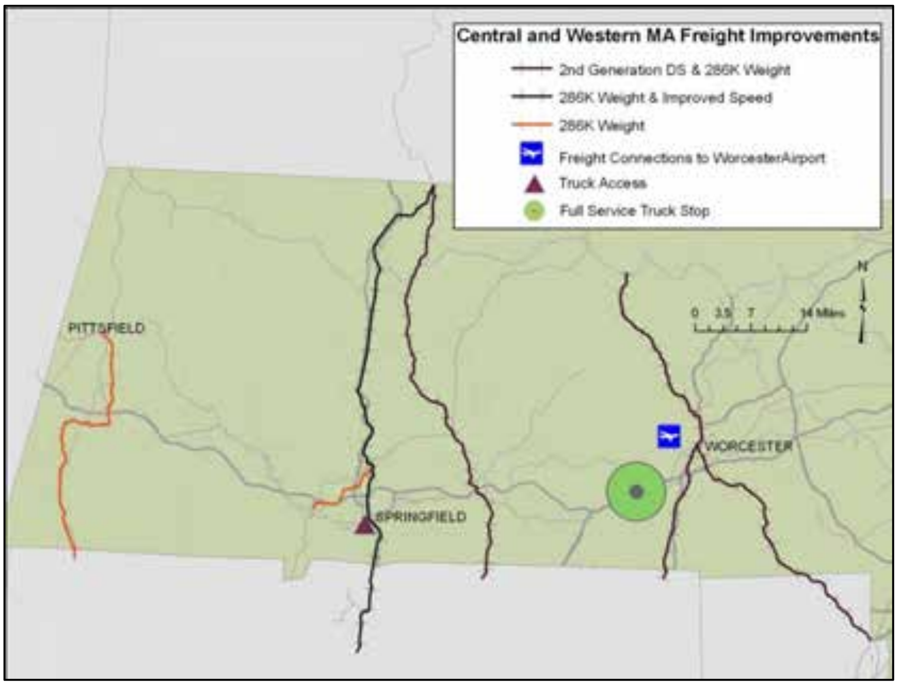
This scenario focuses on double-stack and 286K weight-on-rail north-south rail linkages on Pioneer Valley, New England Central, Pan Am Southern, and Providence and Worcester railroad corridors, in addition to improved truck access to intermodal and aviation facilities, and a full-service truck stop in Central Massachusetts. The specific projects include:

- Upgrades to 286k weight-on-rail and double-stack clearance on north-south rail corridors in the region (NECR and P&W);
- 286k weight-on-rail and improved speeds on the Pan Am Connecticut River Line (coordinated with the proposed Knowledge Corridor passenger rail improvements);
- 286k weight-on-rail upgrade on the PVRR and Housatonic rail corridors;

- Improved truck access to the West Springfield intermodal facility and the Worcester Airport; and
- A new truck stop facility along the MassPike (I-90) between Worcester and the I-84 interchange.

These projects are anticipated to be constructed between 2010 and 2014 at a capital cost of approximately $74.2 million ($66.1 in present value terms). Please note that while the truck access and truck stop investments are deemed as important freight projects in this region of Massachusetts, the costs and benefits of these improvements are not included in the transportation impact and cost-benefit analysis. This is due to a combination of a lack of data on likely benefits and/or the lack of a preferred alternative. Additionally at the time the analysis was conducted a preferred alternative for assessing the Worcester Airport had not been selected. This analysis does include assumptions that there will be air freight improvements upcoming Worcester Airport Improvement Plan.[12]

Figure 5: Central and Western MA Rail Improvements Scenario



Cost-Benefit Analysis

The Central and Western MA Rail Improvements scenario is estimated to cost $74.2M with over 93 percent of funding allocated to projects that increase weight capacity to 286K weight-on-rail and the remaining seven percent to adding double stacking capabilities. The most expensive project in the scenario is the Connecticut River Line corridor ($30M) that not only increases the weight capacity to 286K weight-on-rail but also enhances inter-city passenger rail operations in central Massachusetts, and provides important connectivity between Connecticut and northern

[12] The Worcester Regional Mobility Study is currently assessing the potential alternatives, costs and traffic impacts of improved access to the Worcester Airport. For more information, see http://www.vhb.com/worcesterregionalmobility/

passenger rail demand in Vermont and Montreal.[13] Maintenance of the 286k weight-on-rail line ranges from $33,000 to $159,000 and follows a nine year cycle where for the first three years, no costs are incurred followed by incremental costs for years four through six and seven through nine. The present value of the cumulative capital and O&M costs is presented in Table 28 through 2035.

Table 28: Central and Western MA Rail Improvements Scenario Costs ($Millions)

PV of Total Costs	Construction	O&M
$69.2	$66.1	$3.1

Similar to the Northern Tier Rail Improvements scenario, the Central and Western MA Rail Improvements scenario strengthens rail infrastructure in Central Massachusetts to reduce height and weight limitations. The resulting cost savings are designed to support and encourage companies to divert freight shipments from truck to rail and induce additional rail shipments. Diverting truck shipments is predicted to result in over 1.4M tons of freight transported on rail lines improved by the Central and Western MA rail improvements scenario.

In addition to the shipper cost savings, diverting truck shipments to rail reduces congestion on the highway and provides time savings to remaining trucks and cars. Less traffic decreases the number of accidents and their associated costs. Highway maintenance costs and overall emissions are also consequently reduced. These savings listed in Table 29 are considered benefits.

Table 29: Central and Western MA Rail Improvements Scenario Benefits ($Millions)

PV of Total Benefits	Accidents	Highway Maintenance	Shipper Benefits	Congestion Reduction	Net Emissions
$212.2	$5.7	$19.2	$131.6	$54.9	$0.8

Transportation impacts due to these improvements are focused on how improved north-south rail corridors, connecting to/from the CSX Main Line and the Patriot Corridor, can lead to improve freight rail operations, lower costs, and greater future freight volumes handled by rail rather than truck. These rail corridors provide critical goods movement connectivity to regional markets such as Montreal, Providence, and the New York/New Jersey region.

While these improvements are anticipated to increase intermodal (IM) shipments by more than bulk carloads on a percentage basis, the total increase in freight volumes is larger for carloads since the majority of freight traffic on these corridors is a mix of bulk carload shipments. The total rail tonnage (Table 30) increase is estimated to be almost 1.4 million tons.

[13] The costs and improvements captured in this analysis of the Knowledge Corridor reflect additional improvements to this rail corridor beyond the currently funded project in the baseline conditions.

Table 30: Estimated Annual Transportation Benefits, 2035

Transportation Benefits	
IM Freight Rail Volumes (Truck to Rail)	30% increase, 136,500 tons/year
Rail Carloads (Truck to Rail)	21% increase, 824,900 tons/year
Induced Freight Rail Customer Shipping	442,760 tons/year (IM and Carload)
Reduced Truck VMT	15.5 million VMT in MA, 36.8 million VMT in US

Source: HDR calculations

For this scenario, the estimated NPV is approximately $143 million over the forecast time period and the benefit-cost ratio is estimated to be 3.1 meaning that benefits are 3.1 times greater than costs. Similar to the Northern Tier Rail Improvement scenario, the largest category of benefits, as seen in Table 31, is due to reduced shipping costs based on greater goods movement by rail. The next largest categories of benefits are for highway congestion relief to autos and reduced highway maintenance and repair due to less truck VMT. Based on this analysis, 75 percent of benefits will accrue from economic benefits and cost savings with 25 percent environmental and transportation benefits.

Table 31: Central and Western MA Rail Improvements Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$131.6
Truck Congestion Relief Benefits	$18.8
Freight Logistics Benefits	$8.2
Economic Benefits & Cost Savings	**$158.6**
Auto Congestion Relief Benefits	$27.9
Reduced Emissions	$0.8
Reduced Accidents	$5.7
Reduced Highway Maintenance and Repair	$19.2
Transportation & Environmental	**$53.6**
TOTAL BENEFITS	**$212.2**
Capital Costs	$66.1
O&M Costs	$3.1
TOTAL COSTS	**$69.2**
Net Present Value (NPV)	**$143.0**
Benefit-Cost Ratio	**3.1**

Source: HDR and EDR Group calculations

Economic Impact

Congestion reduction and shipper cost savings account for $9.8M in 2035 (Table 32), $7.7M of which accrues to commercial shippers, receivers, and vehicle operators. These two categories include monetary transactions and result in an economic impact for industries within Massachusetts. The commercial monetary value of time saved (crews, passengers, and freight) due to congestion reduction and the amount saved by switching to lower cost shipping modes are both classified as cost savings for shippers/receivers and vehicle operators.

Table 32: Direct Cost Savings ($Millions)

Cost Saving Categories (2035)	In-State Cost Savings
Shippers and Receivers	$6.20
Cost Savings to Vehicle Operator	$1.50
Household Value of Time Benefit	$2.10
Total	**$9.80**

The indirect and induced effects of cost savings that accrue to shippers and vehicle operators that result from the $7.7M in direct savings produces $15.1M in total business output by 2035 and a total of $171.5M for all years though 2035. This output results in the creation of 845 jobs and $49.8M in wages (Table 33) for 2010-2035 timeframe.

Table 33: Total Operational Impacts

	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
Operational Impact (all years)	$171.50	$75.60	37*	$49.80
Operational Impact (2035)	$15.10	$6.60	71	$4.40

*Denotes average annual jobs over operational period

Industries that ship a large portion of their commodities on the rail network in the Central and Western MA Rail Improvements scenario and their corresponding suppliers will experience the greatest economic impacts. These industries are heavily weighted in manufacturing and trade & transportation. Beneficiaries of indirect and induced spending include professional & information services, financial services and real estate. Other services such as leisure and hospitality and education and health services also benefit from improvements.

Table 34: Operational Impacts by Industry Sector

Major Economic Sectors	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wages ($Mil)
Agriculture, Mining and Utilities	$0.40	$0.20	3	$0.10
Construction	$0.10	$0.00	1	$0.00
Manufacturing	$8.00	$2.40	17	$1.50
Trade and Transportation	$2.40	$1.40	18	$0.90
Financial Services, Real Estate	$0.70	$0.50	2	$0.20
Professional and Information Services	$1.40	$0.80	9	$0.70
Education and Health Services	$0.80	$0.50	9	$0.40
Leisure and Hospitality	$0.50	$0.30	7	$0.20
Government	$0.50	$0.40	3	$0.20
Other	$0.20	$0.10	2	$0.10
Total	**$15.10**	**$6.60**	**71**	**$4.40**

With the infrastructure improvements in place, the incentive of cost savings to divert freight from truck and rail will initiate modal diversion. The cost savings is the catalyst driving additional economic impacts (Table 35) to the region.

Table 35: Operational Impacts by Year

	TOTAL OPERATIONAL IMPACTS - BY YEAR			
Year	Business Output	Value Added	Jobs	Wage Income
	($Mil)	($Mil)		($Mil)
2010	$0.00	$0.00	0	$0.00
2015	$2.30	$1.00	12	$0.70
2020	$4.70	$2.10	23	$1.40
2025	$7.60	$3.40	37	$2.20
2030	$11.00	$4.90	54	$3.20
2035	$15.10	$6.60	71	$4.40

Project improvements are concentrated in the Central and Pioneer Valley region. However, economic impacts were allocated to these regions based on industrial activity associated with those commodities most likely to benefit from improved rail and truck operations affected by the investment envisioned in this scenario. These patterns indicate that employment impacts are concentrated in the Pioneer Valley, Central, and Greater Boston regions.

Cost-Effective Investments Based on Preliminary Analysis

Keeping in mind that further project-level analysis is likely needed, this scenario‟s most promising investment projects from a return on investment basis are:

- Providing double-stack clearance on the P&W, where the key bottleneck is on the Norwich Branch, is estimated to provide a strong return on investment given a relatively low capital cost for lowering track ($1.8 million) and relatively strong freight rail market gain (135,000 tons).

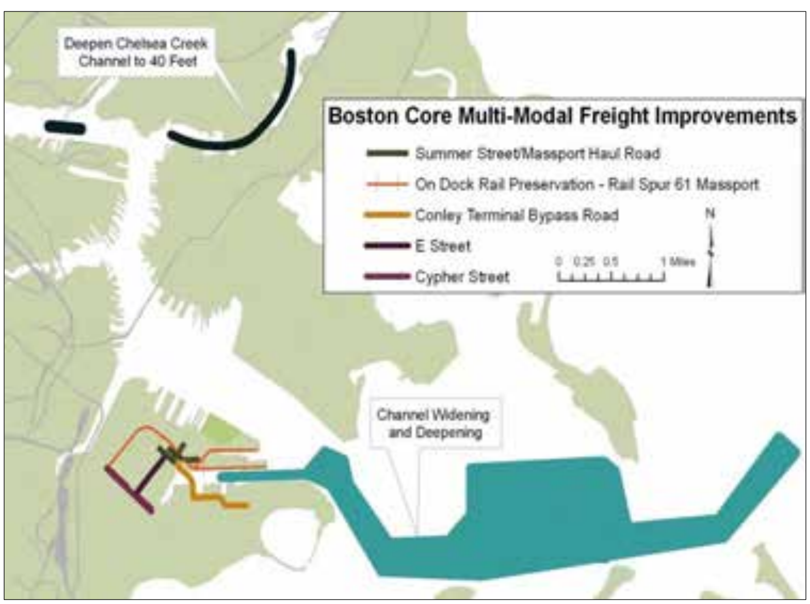
- 286k weight-on-rail upgrades to the PVRR and P&W corridors are estimated to have the next largest benefit compared to cost from a freight rail perspective, followed by the NECR and Pan Am 286k weight-on-rail upgrades (keeping in mind that the Pan Am corridor is expected to return passenger rail benefits as the Knowledge Corridor project restores the Vermonter to that route).

4.6.5 BOSTON CORE MULTI-MODAL FREIGHT IMPROVEMENTS

This scenario concentrates on facilitating the movement and distribution of goods in the Boston metropolitan area by providing connections to the Interstate system and other major highways in Eastern Massachusetts. These improvements are focused on enhancing the competitiveness of operations and goods movement through the Port of Boston. In particular, this scenario includes a major channel deepening project in Boston with supporting truck and rail access improvements. The specific projects are anticipated to be constructed between 2012 and 2016. The improvements include:

- Roadway improvements connecting to and from the Port of Boston in South Boston including the Conley Haul Road, Cypher Street, E Street, and the Massport Haul Road;
- A major deep draft navigational project providing greater marine shipping capacity at Conley Terminal and deeper channels near Charlestown, East Boston and Chelsea;
- On-dock rail preservation for Track 61 providing rail access to the North Jetty (planned for bulk cargo); and
- Supporting policy and regulatory initiatives for heavy load truck routing from the Port to inland distribution centers and for preserving freight and industrial land uses near Logan Airport (e.g., Rt. 1A in Lynn) and South Boston.

Figure 6: Boston Core Multi-Modal Freight Improvements Scenario



Cost-Benefit Analysis

The Boston Core Multi-Modal Freight Improvements scenario focuses on enhancing goods movement to and from the Port of Boston, centered on a major deep draft navigation project, which has been studied, extensively by Massport and the Army Corps of Engineers. Costs and increased throughput estimates, largely intermodal container traffic, are based on those studies.[14] The major port improvement will be the deepening and widening of the main navigation channel to Conley Terminal to better accommodate larger vessels. The improvement dredging includes deepening Chelsea Creek to 40 feet. Paired with the completion of the new Chelsea Street Bridge, the project will allow larger oil tanker vessels to enter. Supporting this increased port activity are planned roadway improvements in South Boston, which are expected to provide more efficient truck routes as well as increased safety for auto, pedestrian, and bike travel in the area. Finally, the Track 61 rail project is aimed at on-dock rail to a planned bulk cargo facility.

The Boston Core Multi-Modal Freight Improvements scenario is estimated to cost approximately $358M ($286.4 in present value terms) with over 86 percent of the project cost allocated to dredging the navigational channel. The Massport Haul Road highway access project consists of 12 percent of total project costs followed by the on-dock rail, which makes up the remaining three percent. The O&M cost differs for each of the projects. Maintenance of the on-dock rail spur ranges from $3,000 to $6,000, and follows a nine year cycle where for the first three years no costs are incurred, followed by incremental costs for years four through six and seven through nine. The present value of the capital and O&M costs cumulative through 2035 are presented in Table 36 for this scenario.

Table 36: Boston Core Multi-Modal Freight Improvements Scenario Costs ($Millions)

PV of Total Costs	Construction	O&M
$289.70	$286.50	$3.30

Improved vessel, truck, and rail access to the port lowers overall shipping costs and is expected to provide an incentive for shippers to divert freight currently being shipped to and from Massachusetts by truck and rail to vessels using the Port of Boston port. These improvements are also expected to divert freight currently being shipped through the Boston port by truck to rail with the addition of an operational on-dock rail spur. These overall shipper cost savings are expected to divert over 2.9M metric tons of freight from truck and rail to vessel and from truck to rail, as seen in Table 37. As with all other scenarios, diverting truck shipments to rail reduces congestion on the highway and provides time savings to remaining trucks and autos, in turn reducing highway maintenance costs and overall emissions. These savings listed in Table 38 are considered the annual benefits.

[14] Boston Harbor Deep Draft Navigation Improvement Study, Draft Feasibility Report (EOEA #12958), US Army Corps of Engineers, April 2008.

Table 37: Estimated Annual Transportation Benefits, 2035

Transportation Benefits	
Increased Marine Cargo Throughput	107% increase, 2.9 million tons/year (86,400 TEUs)
Increased Rail Carloads	2,070 carloads/year
Reduced Truck VMT	11.6 million VMT in MA, 65.5 million VMT in US

Source: HDR calculations

Table 38: Boston Core Multi-Modal Freight Improvements Scenario Benefits ($Millions)

PV of Total Benefits	Accidents	Highway Maintenance	Shipper Benefits	Congestion Reduction	Net Emissions
$415.70	$5.20	$17.60	$310.10	$79.70	$3.10

This scenario provides an estimated NPV of $125.8 million over the forecast time period and the third largest benefit-cost ratio at an estimated 1.4. Similar to the Central and Western MA Rail Improvements scenario, the largest category of benefits is due to shipper cost savings from shifting freight from truck to be carried by the marine system, in addition freight diversion from the port using Track 61, which also results in less truck VMT and improved highway performance. Other significant benefits (Table 39) include $28.4 million in truck congestion relief benefits and $31.1 million in congestion relief benefits to autos. As estimated, 86 percent of benefits are due to economic benefits and cost savings with 14 percent of the benefits directly related to transportation and environmental benefits. As mentioned earlier, these benefits do not include the additional economic activity and jobs at/near the Port of Boston due to greater levels of cargo throughput, those results are explained below.

Table 39: Boston Core Multi-Modal Freight Improvements Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$310.1
Truck Congestion Relief Benefits	$28.4
Freight Logistics Benefits	$20.3
Economic Benefits & Cost Savings	**$358.8**
Auto Congestion Relief Benefits	$31.1
Reduced Emissions	$3.0
Reduced Accidents	$5.2
Reduced Highway Maintenance and Repair	$17.6
Transportation & Environmental	**$56.8**
TOTAL BENEFITS	**$415.6**
Capital Costs	$286.5
O&M Costs	$3.3
TOTAL COSTS	**$289.7**
Net Present Value (NPV)	**$125.8**
Benefit-Cost Ratio	**1.4**

Source: HDR and EDR Group calculations

Economic Impact

Congestion reduction and shipper cost savings including the monetary value of time saved (crews, passengers, and freight) due to congestion reduction and the amount saved by switching to lower cost shipping modes are both classified as cost savings for shippers and others that drive on the highway (e.g. employees on-the-clock, commuters, and personal). These cost savings account for $10.8M in 2035, as seen in Table 40 below.

Table 40: Direct Cost Savings ($Millions)

Cost Saving Categories (2035)	In-State Cost Savings
Shippers and Receivers	$6.4
Cost Savings to Vehicle Operator	$2.5
Household Value of Time Benefit	$1.9
Total	**$10.8**

Savings that accrue to shippers and vehicle operators are likely to be spent or reinvested contributing to overall economic output. This often results in additional purchases from suppliers, which represents “indirect” impacts and also includes the “induced” impacts of consumer spending. The $8.9M in direct savings for shippers/receivers and vehicle operators produces $16.6M in total business output by 2035 and $170.4M for all years. This output results in the creation of 850 jobs and $50.0M in wages (Table 41) for 2010-2035 timeframe.

Table 41: Total Operational Impacts

	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wage Income ($Mil)
Operational Impact (all years)	$170.40	$75.60	43*	$50.00
Operational Impact (2035)	$16.60	$7.40	79	$4.90

* Denotes average annual jobs over operational period

Businesses that would tend to divert their commodities through the Boston Port and their corresponding supplier industries are the sectors that will experience the greatest economic impacts, Table 42 shows the operational impacts by industry.

Table 42: Operational Impacts by Industry Sector

Major Economic Sectors	Business Output ($Mil)	Value Added ($Mil)	Jobs	Wages ($Mil)
Agriculture, Mining and Utilities	$0.4	$0.2	3	$0.1
Construction	$0.1	$0.1	1	$0.0
Manufacturing	$8.5	$2.5	18	$1.6
Trade and Transportation	$3.1	$1.7	21	$1.1
Financial Services, Real Estate	$0.8	$0.5	3	$0.3
Professional and Information Services	$1.5	$0.9	10	$0.7
Education and Health Services	$0.8	$0.5	9	$0.5
Leisure and Hospitality	$0.5	$0.3	8	$0.2
Government	$0.5	$0.5	3	$0.2
Other	$0.2	$0.1	3	$0.1
Total	**$16.6**	**$7.4**	**79**	**$4.9**

With the infrastructure improvements in place, the incentive of cost savings to divert freight from truck and rail will build gradually over the 25-year analysis period. The increased cost savings are indicated in Table 43 and this gradual growth in savings, as well as the other monetary estimates, is reflected in the estimates of the total economic impacts of this project.

Table 43: Operational Impacts by Year

	TOTAL OPERATIONAL IMPACTS - BY YEAR			
Year	Business Output	Value Added	Jobs	Wage Income
	($Mil)	($Mil)		($Mil)
2010	$0.00	$0.00	0	$0.00
2015	$0.00	$0.00	0	$0.00
2020	$4.30	$1.90	21	$1.30
2025	$7.70	$3.40	38	$2.30
2030	$11.80	$5.20	59	$3.50
2035	$16.60	$7.40	79	$4.90

Project improvements were concentrated in the Greater Boston region. However, economic impacts were allocated to all regions of the Commonwealth based on shipping patters that indicate employment impacts concentrated primarily in the Pioneer Valley, Central, and Greater Boston regions.

Cost-Effective Investments Based on Preliminary Analysis

It is particularly difficult to separate the effects of individual projects within the Boston Core Multi-Modal Freight Improvements investment package as the marine and landside transportation improvements are specifically targeted to work in concert to facilitate greater freight volumes at the Port. In terms of cost estimates and objectives of individual projects:

- The deep draft navigational project is estimated to cost $308 million and is thus well beyond the resources of Massport without significant federal and/or state funding. This project is necessary but may not be sufficient to achieve the total projected increase of 86,400 TEUs handled without supporting initiatives.
- The South Boston roadway improvements package totals just over $40 million in capital expenditures and is targeted at both more efficient truck routing as well as safer truck travel through dense urban areas.
- The multi-phase Track 61 rail project has a total cost of $9.5 million and is considered the only near-term chance at the Port of Boston for on-dock rail access (to a planned bulk cargo facility at the North Jetty).

Construction, Operations & Maintenance Impacts

The economic impact analysis portrays the “ripple effects” generated by the construction and operations of the transportation improvements. These effects are measured in terms of direct (spending on-site for construction and operations), indirect (suppliers that support on-site spending) and induced (worker re-spending of wages).

The direct spending for each scenario was estimated for both the initial construction and continued annual operating budgets for each scenario. These included both the necessary labor and purchases of materials to support construction and continuing operations. In many cases, annual O&M costs varied from year to year depending on the repair and renovation requirements for each mode involved. The overarching standard was to maintain capital improvements made under each scenario in a state of good repair for the entire analysis period. Table 44 provides the information on the impact analysis for construction and also includes the present value of construction costs as a reference. From the table, it is evident that the Boston Core Multi-Modal Freight Improvements scenario has the second highest construction costs of all the scenarios yet has the third highest level of economic impacts.

With a similar port focus, the South Coast Multi-Modal Freight Improvements scenario has lower costs than the Boston Core Multi-Modal Freight Improvements scenario yet has almost double the economic impacts. This is because South Coast Multi-Modal Freight Improvements scenario has a total dredging requirement of $36M (23 percent of total capital costs) while the Boston Core Multi-Modal Freight Improvements scenario has over $307M (86 percent of total capital costs) for dredging services. Dredging services required for navigational and berth improvements are most likely to be provided by a firm outside the Commonwealth of Massachusetts. The economic impacts of the dredging were computed using a 20 percent regional purchase coefficient.[15] Therefore, with over 86 percent of total capital costs planned to be spent on dredging, the Boston Core Multi-Modal Freight Improvements is estimated to have a large portion of these funds “leaking” outside the Commonwealth, which lowers the overall economic impact.

Table 44: Construction Impacts (All Years)

Construction Impact	Northern Tier Rail	South Coast Multi-Modal	Central and Western MA Rail	Boston Core Multi-Modal	Truck Freight
Business Output ($M's)	$ 155.0	$ 242.2	$ 114.4	$ 121.9	$ 13,491.1
Value Added ($M's)	$ 89.1	$ 140.5	$ 62.1	$ 69.2	$ 7,429.5
Jobs	484	1,722	388	763	94,635
Wage Income ($M's)	$ 39.5	$ 100.8	$ 29.2	$ 47.6	$ 5,679.0
Construction Costs ($M's)	$ 93.2	$ 131.1	$ 69.2	$ 289.7	$ 4,900.2

Source: EDR Group TREDIS®, 2010

Operations and Maintenance expenditures are illustrated in Table 45 and vary by project scenario. The South Coast Multi-Modal Freight Improvements scenario has the highest O&M costs overall due to on-going maintenance cycles for highway/bridges, rail lines, terminals, transload, and multi-use facilities. The Boston Core Multi-Modal Freight Improvements includes dredging costs in the overall O&M budget, which is the largest maintenance cost of all the scenarios.

[15] A Regional Purchase Coefficient (RPC) is the proportion of the total demand for a commodity by all users in the Study Area that is supplied by producers located within the Study Area.

Table 45: Operations and Maintenance Impacts ($Millions)

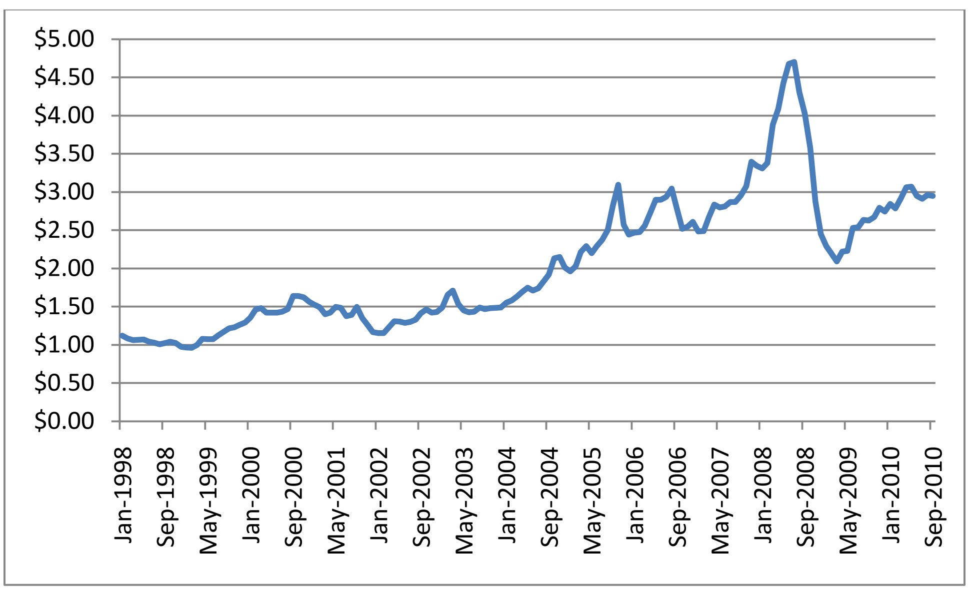
		Northern Tier Rail	South Coast Multi-Modal	Central and Western MA Rail	Boston Core Multi-Modal	Truck Freight
O&M Impact (2035)	Business Output ($M's)	$ 0.5	$ 3.0	$ 0.5	$ 0.5	$ 121.6
	Value Added ($M's)	$ 0.3	$ 1.7	$ 0.2	$ 0.3	$ 67.0
	Jobs	3	21	3	3	853
	Wage Income ($M's)	$ 0.2	$ 1.3	$ 0.2	$ 0.2	$ 51.2
O&M Impact (all years)	Business Output ($M's)	$ 14.1	$ 32.6	$ 11.9	$ 12.7	$ 677.4
	Value Added ($M's)	$ 7.8	$ 17.9	$ 6.6	$ 7.0	$ 373.1
	Jobs	103	227	84	84	4,753
	Wage Income ($M's)	$ 5.9	$ 13.7	$ 5.0	$ 5.4	$ 285.2
	O&M Costs (PV)	$ 3.8	$ 4.5	$ 3.3	$ 3.3	$ 136.6

Source: EDR Group TREDIS®, 2010

4.7 FUEL PRICES

Fuel prices are a significant and growing factor in transportation costs, and they impact the cost for producers as well as consumers. After 2005, diesel fuel prices began to rise, leveling off in early 2007, and then dramatically increasing to over $4.50 a gallon during the summer of 2008. Since then, diesel fuel prices have declined to just below 2004 prices. The prices are again increasing but a more moderated rate. The combination of high fuel prices and the onset of economic recession placed significant pressure on the freight industry and businesses, reducing freight tonnages and affecting modal shipping choices. Because of this recent volatility in fuel prices, an analysis was done to assess the sensitivity of the investment scenario analysis to the affect of fuel prices.

Figure 7: Monthly Retail Diesel Fuel Prices



Source: Energy Information Administration (EIA)

The transportation industry has increased energy efficiency since the 1970s, operating on less fuel per vehicle and ton-mile. Trucking, the predominant form of freight transportation, is significantly less energy efficient on a ton-mile basis than rail or marine modes. Freight trains are between 2 and 5 times more efficient on a per-ton mile basis for transporting long-haul freight. Based on this difference, rises in fuel prices can result in the potential for modal shifts to occur between truck and rail, in an effort to take advantage of the lower costs associated with rail.

According to the Energy Information Administration, estimated long-term trends in the real price of fuel are growing slower than the consumer price index. It is still uncertain, however, whether fuel prices may exhibit prolonged sharp increases in the future.

If diesel prices dramatically increase, there is the potential for movement from truck to other modes to reduce the increased transportation costs. The most likely segments of freight that would switch modes would be long haul, non-time sensitive bulk freight. However, given the dominant truck modal share in Massachusetts at over 86 percent, shifts in mode share are projected to be modest under any circumstances. Because of this, the investment scenario analyses are based on the price of fuel following the rate of inflation. This enables a determination of how these investments will influence transportation and modal shifts, outside of fuel price and other temporary market fluctuations.

Through public outreach efforts and presentations comments were received regarding what impact higher fuel prices would impact the investment scenario results. As the non highway based scenarios are anticipated to be most influenced by dramatic increases in fuel prices, the following sensitivity analysis was conducted. To address this an increase in fuel prices was applied to the investment scenarios to determine the potential impacts fuel prices may have on scenario outcomes. This high level analysis assumed fuel prices will increase at an annual rate 50 percent above projected inflation rate, as measured by the consumer price index (CPI). This increase in fuel prices was chosen since diesel fuel prices in 2008 increased 32 percent over 2007 prices, and initial sensitivity analysis showed fuel prices had negligible impacts on the investment scenario analysis.

Based upon research from the Victoria Transport Policy Institute (VTPI) and National Cooperative for Highway Research Program (NCHRP), long-haul truck freight volumes were adjusted down based upon the proportional increase in shipper costs due to the increase in fuel prices.[16] Fuel prices were assumed to increase on an annual basis rather than a one time increase in cost. Meaning in year one fuel prices grew 1.5 percentage points more than inflation, and by the end of the forecast period fuel prices were 49 percentage points greater than inflation. The year one cost of diesel fuel was $2.94[17] and rose to $10.34 dollars per gallon by 2035. The 2035 fuel price is $3.40 more per gallon than if fuel prices rose at the same rate as inflation.

The analysis results from the VTPI and NCHRP were used to identify that if fuel prices increase annually 50 percent above the CPI, the forecasted growth for long haul truck would decline 12 percent per year. Of the reduced forecast for truck shipments, six percent of the decline would be diverted to other modes. Applying these assumptions to each of the multi-modal investment

[16] Victoria Transport Policy Institute (VTPI), "Transportation Demand Management (TDM) Encyclopedia."
[17] Energy Information Administration (EIA), "Monthly U.S. No 2 Diesel Retail Sales"

scenarios modestly increased the BCR principally due to reduced truck traffic providing congestion relief, environmental, and safety benefits. The estimated increases in the BCR for each multi-modal scenario are:

- The Northern Tier Rail Improvement scenario"s BCR increases from 3.7 to 4.2
- The South Coast Multi-Modal Freight Improvements scenario"s BCR increases from 1.0 to 1.4
- The Central and Western MA Rail Improvements scenario"s BCR increases from 3.1 to 3.7
- The Boston Core Multi-Modal Freight Improvements scenario"s BCR increases from 1.4 to 2.0

The results demonstrate that a significant increase in fuel costs impact the results to a lesser degree than originally anticipated. Given the large increase in fuel price the impacts to the multi-modal scenario analysis are disproportionate, and provide additional public benefits.

4.8 SUMMARY FINDINGS OF INVESTMENT SCENARIOS

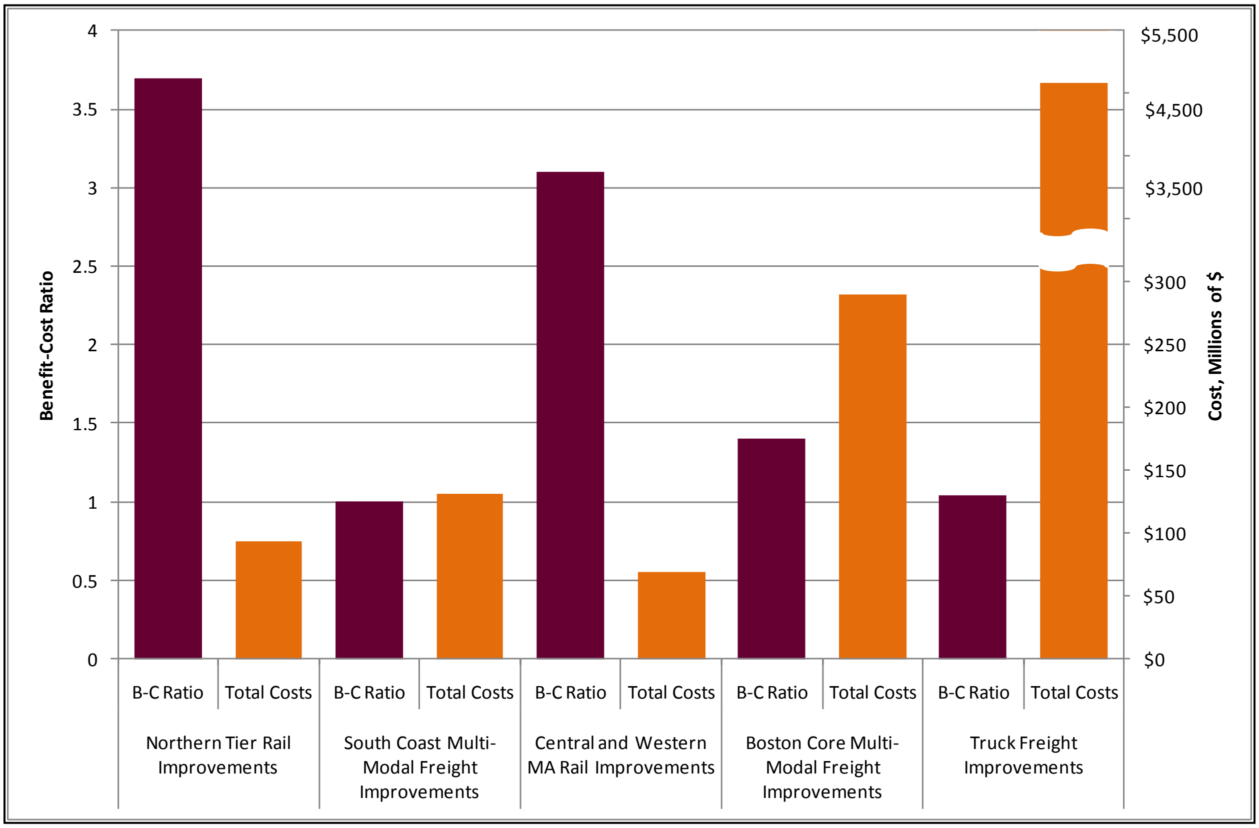
The analysis of investment scenarios and the projects that comprise each investment package are helpful in assessing priorities and strategies for the Commonwealth to improve goods movement and enhance the competitiveness of the Commonwealth. Findings suggested by the scenario analysis include:

All of the five of the investment scenarios are estimated to have a positive return on investment with benefit-cost ratios at or above 1.0 (see Figure 8) with the Central and Western MA and Northern Tier Rail Improvement scenarios above 3.0.

- The Truck Freight Improvements scenario showed a net benefit with a BCR of 1.04 but also presents challenges, as it is by far the most expensive option that exceeds all expected federal and state funding. It also would induce highway travel. This in turn would increase greenhouse gas emissions, creating conflict with federal clean air standards and the recently established state target carbon reductions through Chapter 21N, the Global Warming Solutions Act (GWSA). Additionally, any project delays, environmental permitting issues, or other project financing complications could easily increase the costs above the overall benefits. It is important to note that highway improvements generally have benefits for both passenger vehicle users and freight users. Thus freight benefits should be considered when evaluating any highway improvement.
- Overall, the investment scenario results clearly show that investment intended to improve goods movement, even on privately owned assets, has both public and private benefits through reduced travel time, improved levels of congestion, reduced maintenance of publicly-owned infrastructure, and reduced emissions. These benefits demonstrate the potential benefits to be realized through public/private partnerships.
- The investment scenarios shifting freight from truck to rail or water will reduce overall mobile emissions. The table below shows the reduction Greenhouse Gases (GHG) in tons for each multi-modal scenario. The Truck Freight Improvements scenario significantly increases the amount of GHG emissions.
- Without making any freight rail improvements, the baseline TRANSEARCH forecast estimates that the freight rail mode share will *decrease* from about 6.5 percent to 6.1 percent as truck volumes continue to increase more rapidly. With the freight rail

improvements assessed in these scenarios, along with the planned CSX Boston Line double-stack project, freight rail volumes are estimated to not only maintain current mode share but also increase the share of goods handled by freight in the future.

Figure 8: Benefit-Cost Ratio by Investment Scenario



Source: HDR and EDR Group calculations

Table 46: Greenhouse Gas Impact by Investment Scenario

Scenario	Tons of GHG
Northern Tier Rail Improvements	(2,640)
South Coast Multi-Modal Freight Improvements	(1,070)
Central and Western MA Rail Improvements	(1,350)
Boston Core Multi-Modal Freight Improvements	(3,120)
Truck Freight Improvements	1,005,480

Source: HDR calculations based on EPA data

The scenario analysis demonstrates that there are significant public benefits from these freight focused improvements in terms of transportation, time savings, and environmental benefits. However, for most scenarios the vast majority of benefits – 75 percent to 92 percent for scenarios two through five – accrue to economic benefits and cost savings for shippers and carriers. This suggests that there may be opportunities for public private partnerships for these improvements. The results of this investment scenario analysis are placed in context within policy recommendations contained within Section 5.

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5 Findings and Recommendations

This section of the freight plan includes an assessment of freight funding resources, opportunities and challenges, and concludes with strategic findings, identification of high return on investment projects, and policy recommendations to support an efficient and cost-effective multi-modal freight system in Massachusetts.

5.1 FREIGHT FUNDING AND FINANCING

The Freight Plan details the existing facility needs and priorities for enhancing system efficiency and effectiveness. Identifying funding opportunities for the related priority projects for improvement of the freight system is an important component of the planning effort.

Funding for capital improvements to the transportation system comes from a variety of sources, many of which are public. One exception to this is investment in freight rail infrastructure, which is generally privately owned, operated and maintained. Because of this private ownership structure, there may be opportunities for private and public collaboration to fund freight rail projects similar to private/public partnerships with land developers.

A principal element of the funding evaluation is identification of major revenue sources within the Commonwealth and federal financing structure. This effort includes assessment of freight financing options and programs available in other states, as well as potential strategies to enhance funding opportunities for freight transportation infrastructure.

5.1.1 STATE AND FEDERAL TRANSPORTATION FUNDING STRUCTURE

There exist numerous Commonwealth and federal organizations involved in the funding and operation of the transportation infrastructure in the Commonwealth of Massachusetts.

Federal funding provided to the Commonwealth for transportation programs comes in two forms, apportionments and allocations. Apportionment funds are determined annually, based on federal formulas to distribute federal funding among all states, and there are a number of criteria used to apportion federal funds.[1] The apportionment formulas are typically based upon population, infrastructure use, and facility conditions, and they represent the largest portion of federal funding provided to Massachusetts for transportation. Each apportionment of funding provided to Massachusetts has a specific source and function. For example, Metropolitan Planning Organization (MPO) financing supports transportation investments in metropolitan areas to move freight and people and to enhance connectivity in the transportation system. Current federal apportionment programs include:

- Interstate Maintenance;
- Surface Transportation Program;
- Recreation Trails;
- Metropolitan Planning;
- Safe Routes to Schools;
- National Highway System;
- Rail Highway Crossings Program;
- Congestion Mitigation and Air Quality Improvement;
- Bridge;

[1] "Financing Freight Improvements," FHWA 2007.

- Coordinated Border Infrastructure; and
- Highway Safety Improvement State Transportation Funding.

Federal funding allocations and grants provide financial assistance to states to implement systems, develop programs, or comply with federal regulations. Most funding allocation programs have a state/local matching requirement, unlike apportionment funding. Most allocation programs require a 20 percent non-federal match to access the 80 percent federal.

Freight related activities, including interstate maintenance, national highway system, surface transportation program, mobility enhancement, bridge and congestion mitigation, all qualify for federally allocated funds. The federal allocation programs include:

- NHSTA/FHWA Highway Safety Program;
- ITS Standards, Research and Metropolitan Deployment;
- Forest Highways;
- Emergency Relief;
- Motor Carrier Safety Assistance Programs; and
- High Priority Projects Parkways and Park Roads.

As an overview of funding resources and sources of revenue, Figures 1 and 2 present the state and federal shares of revenue collected for transportation funding in Massachusetts and the breakdown of the specific transportation revenue sources generated in the Commonwealth.

Figure 1: Commonwealth and Federal Shares of Transportation Revenue

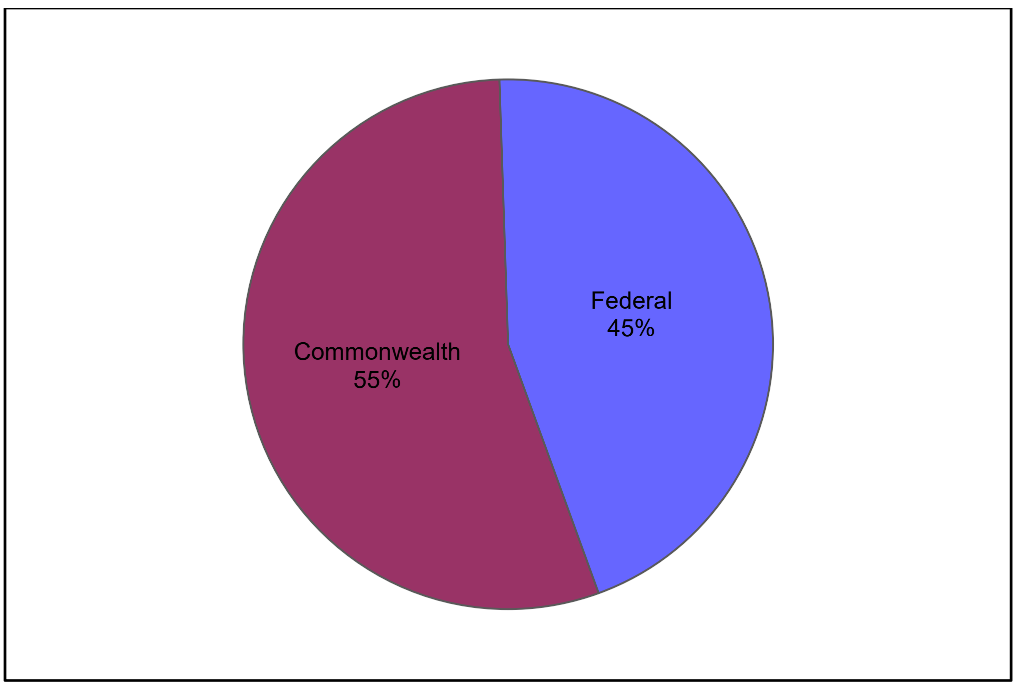
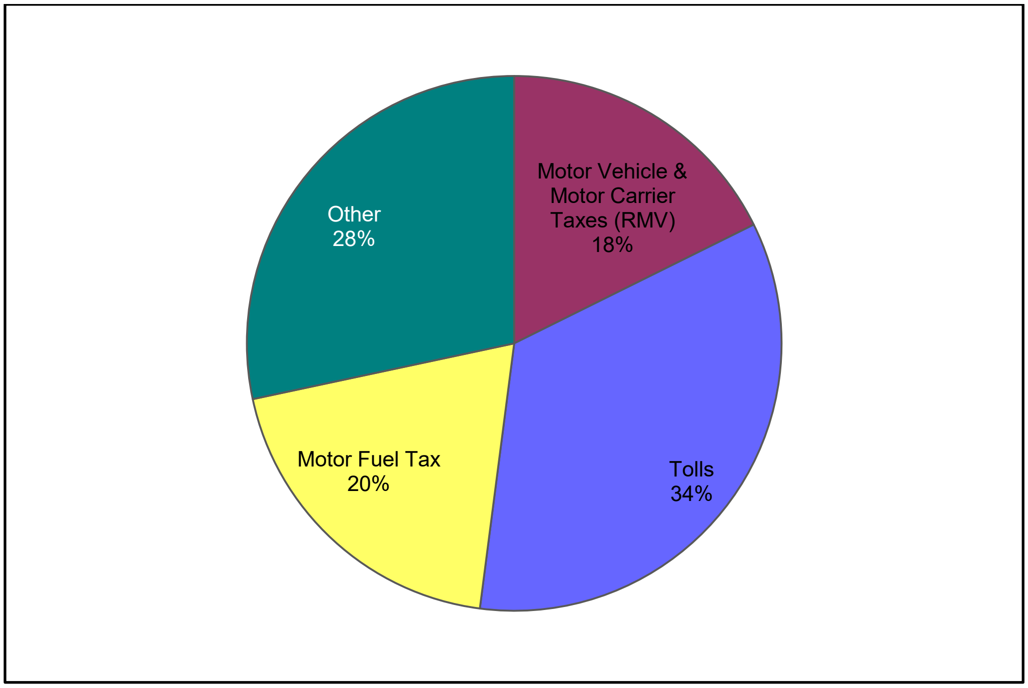


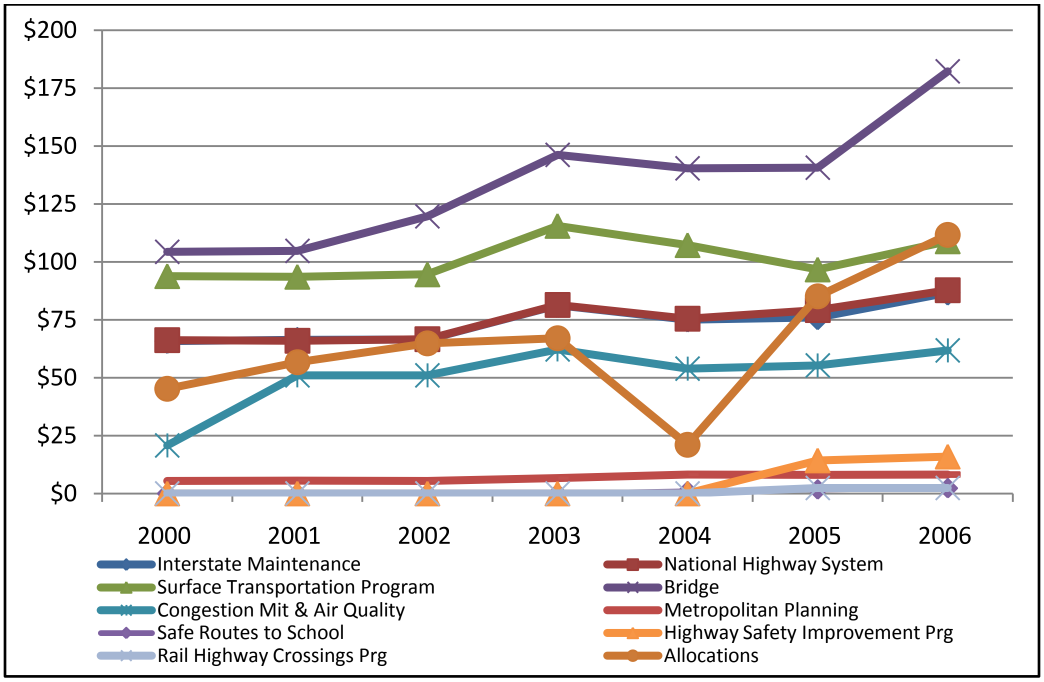
Figure 2: Commonwealth Transportation Revenues by Source



In 2006, the total federal transportation contributions to Massachusetts were $683 million dollars, of which 16 percent came in the form of allocations. The remaining $571 million were federal apportionments as shown in Figure 3. This suggests that the total federal apportionments to Massachusetts were roughly five times larger than the total federal fund allocations for 2006.

Federal funds accounted for 35 percent of total 2006 revenues to Massachusetts. Approximately 94 percent of the total federal transportation funding apportionments and allocations in the Commonwealth benefit freight movement. Federal funds to Massachusetts for interstate maintenance, the national highway system, surface transportation system, and bridges have all increased from 2000 to 2006.

Figure 3: Major Federal Funds Apportionments by Source ($Millions)



Source: Federal Highway Administration

5.1.1.1 Commonwealth Agencies' Revenue, Expenditures and Responsibilities

Transportation financing in Massachusetts is complex, and responsibilities have historically been divided among a number of public and quasi-public agencies. In November 2009, the Commonwealth integrated its transportation agencies and authorities into a new, streamlined Massachusetts Department of Transportation (MassDOT). The organization is overseen by a five-member Board of Directors appointed by the Governor, which serves as the governing body of both MassDOT and the Massachusetts Bay Transportation Authority (MBTA). The MBTA is organizationally a part of MassDOT, but retains a degree of legal and financial independence. MassDOT is administered by the Secretary of Transportation who is appointed by the Governor to serve as Chief Executive Officer. The agency oversees four new divisions: Highway; Rail and Transit; Aeronautics, and the Registry of Motor Vehicles (RMV), along with shared services that include the Office of Transportation Planning.

The newly-established MassDOT assumed operations from the former conglomeration of Commonwealth transportation agencies. Creation of MassDOT involved merging the Massachusetts Turnpike Authority and MassHighway into the Highway Division. It also transferred the Tobin Bridge from Massport to the Highways Division of the new agency, and the ownership of bridges was shifted from the Department of Conservation and Recreation to MassDOT. The Massachusetts Aeronautics Commission (MAC) and the Registry of Motor Vehicles also became part of the new MassDOT. Finally, the planning and oversight functions of the Executive Office of Transportation (EOT) were merged into a new organization.

Work on the Freight Plan began prior to MassDOT„s establishment. As a result, the data and information related to the Commonwealth‟s funding of transportation was based on the previous organizational structure within Massachusetts. Because MassDOT was not established until November 2009, funding data for each element of the new agency is not yet available.

MassDOT Highway Division

MassHighway was integrated into MassDOT"s Highway Division in the fall of 2009, along with three other Commonwealth agencies. Its responsibilities include the design, construction and maintenance of all Commonwealth highways and bridges, as well as signage of numbered routes. Historically, MassDOT received funding from the Highway Transportation Fund. In 2006, total expenditures for MassDOT were $1.3 billion, $1.1 billion less than the level of spending in 2000.

Massachusetts highway spending in 2000 represented 86 percent of all capital outlays and by 2006, the Commonwealth highway share dropped dramatically to 68 percent. During this same period, maintenance remained roughly between eight and 18 percent of the total highway spending.

The Massachusetts Turnpike Authority was incorporated into MassDOT as part of the 2009 reorganization. It is now part of the Highways Division of the new agency and has assumed control of 138-mile Massachusetts Turnpike (I-90) from West Stockbridge to Logan Airport, the Thomas P. O"Neill Turnpike Extension, and Ted Williams Tunnel. In addition, MassDOT Highway Division assumed control of the Tobin Bridge from the Massachusetts Port Authority.

Despite recent reductions in vehicle miles traveled, toll revenue has increased in Massachusetts, in part because of the toll rate increase (60 percent increase between Route 128 and Allston, and 100 percent at the Sumner and Ted Williams Tunnels) that occurred on January 1, 2008. The total toll revenue for 2007 and 2008 is presented in Table 1.

Table 1: Massachusetts Toll Revenues ($Millions)

	2001	2002	2003	2004	2005	2006	2007 - 2008*
Toll Revenue	$187.8	$214.4	$244.1	$256.9	$259.0	$257.2	$410.6
Concession revenue	$14.0	$14.4	$18.1	$16.6	$15.9	$16.6	$25.6
Other	$33.8	$27.2	$25.2	$32.1	$31.4	$31.2	$52.4
Total Operating Revenue	**$235.5**	**$256.0**	**$287.4**	**$305.6**	**$306.3**	**$305.0**	**$488.6**

* Represents 18 month period from FY2007 through June of FY2008.
Source: Massachusetts Turnpike Authority Comprehensive Annual Report

MBTA

Formed in 1964, the MBTA was created to finance and operate most bus, subway, ferry and commuter rail systems in the Boston metropolitan area. The MBTA is primarily financed by sales taxes collected in the Commonwealth of Massachusetts. In FY2008, the MBTA"s total revenue collection was 31.3 percent in ridership fares, 53.7 percent in sales tax revenue, and 4.8 percent in other system generated revenues, and 10.5 percent in assessments.[2] The MBTA had a deficit of $160 million in FY 2010.

The two largest MBTA expenses are wages and debt service from previous capital improvements and other debt transferred to the MBTA. Since 2000, debt service has accounted for 20 to 30 percent of total expenses. To compensate, the MBTA has been restructuring debt for lower principal payments often resulting in larger interest payments. In FY2008, debt

[2] "Born Broke: How the MBTA found itself with too much debt, the corrosive effects of this debt and a comparison of the T"s deficit to its peers," MBTA Advisory Board, April 2009.

service, wages, and fringe benefits accounted for 63 percent of the MBTA‟s operating expenses. The remaining MBTA operating budget was spent on operating local services, the commuter rail service contract, and other materials and supplies.

Massachusetts Port Authority

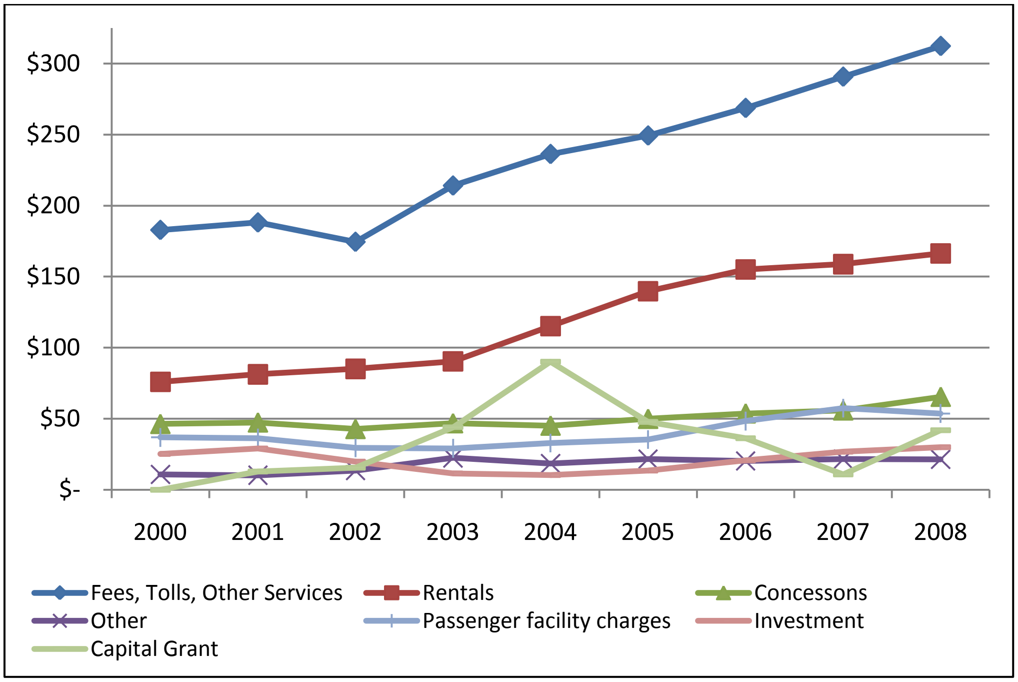
The Massachusetts Port Authority (Massport) is an independent public authority that maintains, manages, and improves airports in central and eastern Massachusetts, and the Port of Boston. Specifically, the authority operates Boston Logan International Airport, as well as two other airports in the region: L.G. Hanscom Field in Bedford and Worcester Regional Airport, which it also owns. L.G. Hanscom Field is the region‟s largest general aviation airport, providing private and corporate aircraft services, as well as some commercial service. Worcester Regional Airport is located in Central Massachusetts.

Massport is governed by a seven member board of directors appointed by the Governor. The authority is self-supporting and receives no Commonwealth tax funds to support its operations or facilities. Massport has the authority to issue revenue bonds and collect fees for use of its facilities. The following is a list of fees that Massport collects:

- **Air –** Landing fees, terminal rentals, passenger facility charges, and parking fees
- **Port –** Container handling, cruise ship and automobile cargo holding

Massport collected fees and other service revenues totaling $312.3 million for FY2008, a $21.6 million increase over 2007. Massport‟s major revenue sources are shown in Figure 4. In addition to these sources of revenue, Massport participates in a number of other programs to fund its capital improvements. These include the Federal Aviation Administration‟s (FAA‟s) Airport Improvement Program (AIP), which provides funding for airport planning, development, and noise abatement. As of 2008, AIP provided Massport with $39.4 million for airport planning and improvement efforts.

Figure 4: Massport Revenue, Fiscal Years 2000-2008 ($Millions)

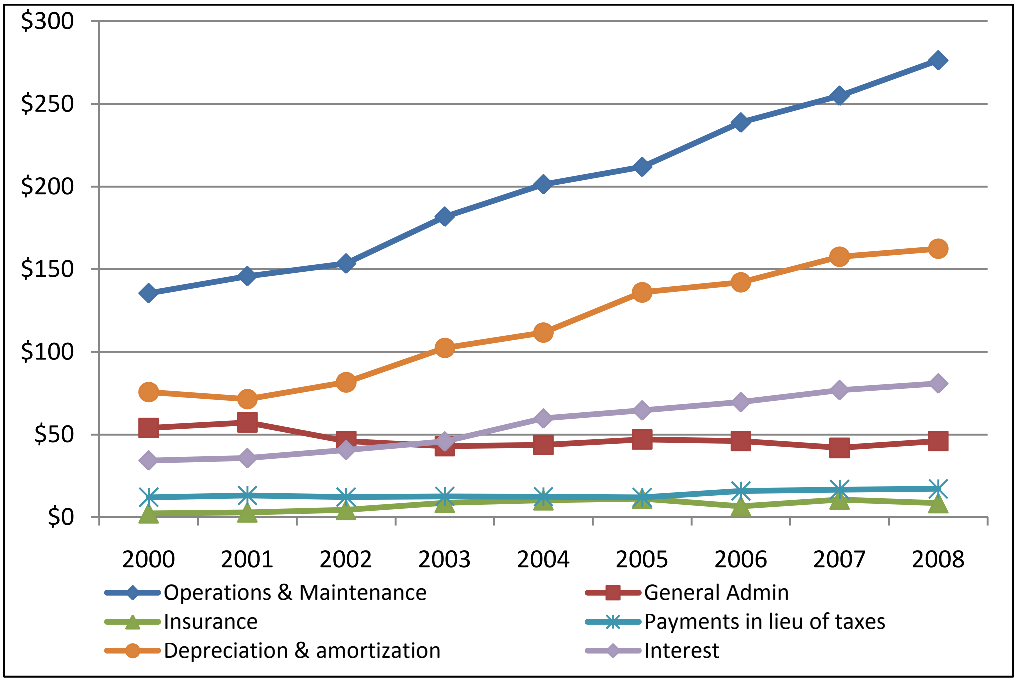


Source: Massachusetts Port Authority Comprehensive Annual Financial Report 2001-2008

Massport"s operating expenses were $526.4 million[3] for FY 2008. While operations and benefit payments have increased similar to other agencies, Massport"s general administration fees have remained relatively flat since 2000. Overall bonds payable decreased by $32.7 million (two percent) in 2008 through refunding outstanding debt obligations.[4] Post employment benefit expenses also increased through the adoption of GASB 45[5] increasing post-employment expenses by $15.9 million. The increase in operations and maintenance fees from 2007 are attributable to cost escalation for services and maintenance, wage increases, elevated security requirements, and additional employee benefits.[6]

[3] Sum of all expenditure categories in Figure 5.
[4] Massport Comprehensive Annual Financial Report (CAFR), 2008.
[5] Accounting and Financial Reporting for Post-employment Benefits Other than Pensions.
[6] Massport CAFR, 2008.

Figure 5: Massport Expenditures ($Millions), Fiscal Years 2000-2008



Source: Massachusetts Port Authority Comprehensive Annual Financial Report 2001-2008

Massachusetts Seaport Advisory Council (SAC)

The Massachusetts Seaport Advisory Council advises the Governor about seaport development policy and funding and coordinates all seaport development activities in Massachusetts. SAC uses general obligation bonds authorized by the Seaport Bond Bill (Section 2 Chapter 28 of the Acts of 1996) to fund capital improvement projects for Massachusetts ports.

SAC is chaired by the Commonwealth‟s Lieutenant Governor and consists of 15 Governor-appointed members including cabinet secretaries, agency heads, mayors from seaport communities, and regional and waterway user representatives. The Council was originally funded through the $280 million Seaport Bond Bill in Chapter 28 of the Acts of 1996. It is currently funded by a $110 million line item in the Energy and Environmental Bond Bill of 2008.[7]

The Seaport Bond Bill included provisions for funding assistance to the Commonwealth‟s major commercial ports to conduct comprehensive harbor development.[8] The following programs have been supported:

- **Commercial Fishing Infrastructure (CFI) –** Support has been given to the fishing industry with infrastructure improvements to promote competitiveness.
- **Dredging Maintenance and Improvement (DMI) –** Funding has been committed to the Commonwealth's dredge management and disposal plan (DMDP), which designates statewide off-shore disposal sites for disposal of contaminated dredge material and is intended to expedite dredge permitting processes.

[7] http://www.mass.gov/?pageID=gov3subtopic&L=5&L0=Home&L1=Our+Team&L2=Lieutenant+Governor+Timothy+P.+Murray&L3=Councils%2c+Cabinets%2c+and+Commissions&L4=Seaport+Advisory+Council&sid=Agov3.
[8] "Gloucester Harbor DMMP Draft Environmental Impact Report (DEIR)."

- **Port Marketing (MAR) –** Funding has been provided to market the "Port of Massachusetts" to vessel operators, investors, and tourists. Promoting the ports in the re-emerging Short Sea Shipping network and the institution of the Historic Ports of Massachusetts Cruise Line has been the focus of this marketing effort.
- **Public Access/Boardwalks (PAB) –** The goal of this program is to provide a connection between the waterfront and the public. Projects funded have included the construction of the Fall River Boardwalk and reconstruction of the Newburyport boardwalk. Efforts are now underway in Salisbury, Salem, Newburyport (Cashman Park) and Plum Island.
- **Port Institutional Infrastructure (PII) –** Development of comprehensive municipal harbor plans, waterfront assessment studies, and other institution infrastructure has been supported.
- **Port Physical Infrastructure (PPI) –** Investment in docks, wharfs, piers, warehouses, and equipment have been invested in to equip the ports with state-of-the-art terminal technology and infrastructure.
- **Safety and Security (SAS) –** Safety and security investments to support the smaller ports in the Commonwealth have been funded.

Currently there is no maximum grant amount or limit on how often a port may request funds. Match requirements vary by type of project and whether it is located in a Commonwealth designated port area established in the Seaport Bond Bill. Approval for SAC funds typically occurs four times a year at SAC quarterly meetings. Projects for FY 2008 included:

- **New Bedford –** $5.5 million for the construction of cellular aquatic disposal (CAD) cells and completion of underway dredging project; $75,000 to upgrade a fireboat; $40,000 to remove a sunken vessel interfering with navigation; $2.5 million project for structural repairs and assessment of the State Pier.
- **Fall River –** $1.1 million for the State Pier to repair its south berth and install a new floating dock.
- **Gloucester –** $400,000 for an economic development plan for Gloucester Harbor.
- **Salem –** $2.3 million for a port expansion project to purchase land, finalize the permitting process, and prepare engineering and preconstruction.

5.1.1.2 Commonwealth Funding

The Commonwealth has made some significant changes in the past few years, in an effort to improve the manner in which it manages and funds its transportation system. Agencies and authorities have been consolidated.

In 2004, prior to MassDOT, the Transportation Finance Commission was created to evaluate the financial health of the Commonwealth‟s transportation agencies and authorities. It was created as an independent body to conduct financial evaluations of the transportation agencies and authorities. The commission makes recommendations based on their findings, and they have completed several reports recording these conclusions. A key finding is that the Commonwealth does not have sufficient funds to support its transportation infrastructure.

The Massachusetts Transportation Finance Commission found that there is a transportation funding gap in Massachusetts of $15 to $19 billion to bring the Commonwealth‟s existing assets to a state of good repair. These estimates include operating and capital needs, but do not include any expansions or enhancements of the existing transportation infrastructure in the Commonwealth.[9]

Historic Transportation Funding in Massachusetts

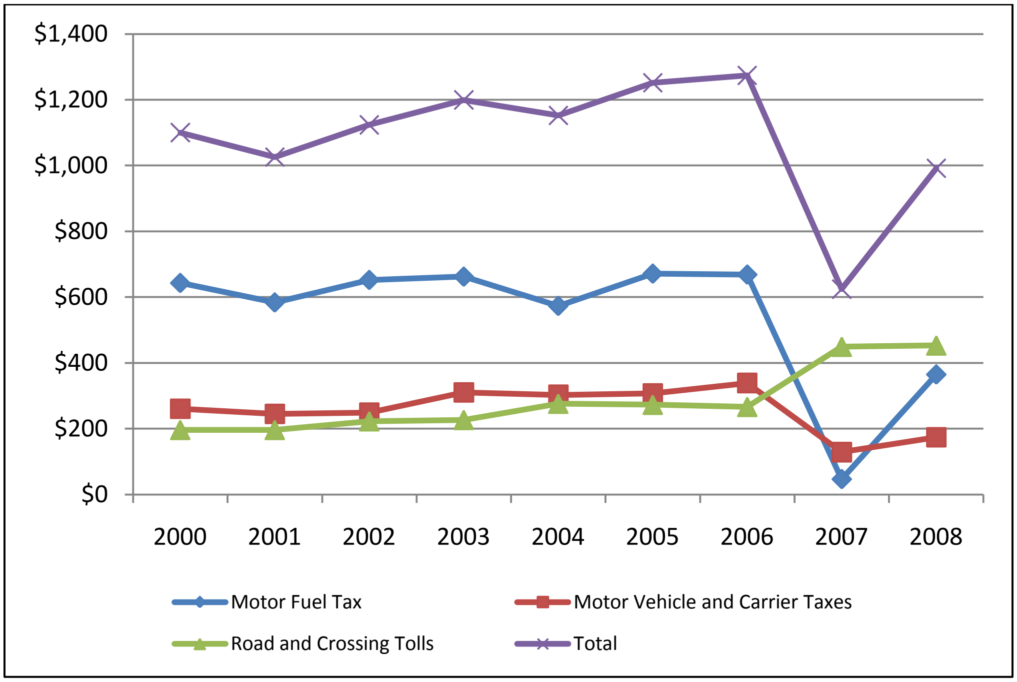
Revenues to fund transportation in Massachusetts have traditionally come primarily from Commonwealth collections, bonds, and federal apportionments and allocations. Massachusetts funding for transportation has four distinct revenue sources: the allocated funding from the Commonwealth‟s General Fund budget; registrations and fees; motor vehicle fuel taxes, and tolls.[10] These revenue streams are assigned to specific passenger and freight related transportation infrastructure funds. Commonwealth funds are used to operate, maintain, and improve critical Massachusetts‟ infrastructure, which includes highways, bridges, rail, and ports.

In 2006, Massachusetts collected $1.2 billion in transportation revenues from motor fuel taxes, road and crossing tolls, and motor vehicle and motor carrier taxes. As shown in Figure 6, motor fuel tax collections have remained relatively flat, due to a combination of relatively slow or no growth in the total vehicle miles traveled (VMT) in Massachusetts and the fuel tax rate that has not been changed since 1991.

The motor vehicle and motor carrier tax represent collections from licensing and registration fees; this is the only fund to maintain positive year-to-year growth. In total, the average annual growth for Commonwealth transportation revenue from 2000 to 2006 was three percent, during a period of time when construction costs were experiencing high levels of inflation, as asphalt prices increased over nine percent during that period.[11] Following that period motor fuel tax and motor vehicle and carrier receipts declined significantly in 2007 and 2008.

[9] "Transportation Finance in Massachusetts: An Unsustainable System," Findings of the Massachusetts Transportation Finance Commission, March 28, 2007.
[10] FHWA Highway Statistics Report.
[11] Bureau of Labor Statistics, Producer Price Index.

Figure 6: Total Commonwealth Receipts ($Millions)



Source: Federal Highway Administration
Note: Road and Crossing Toll data are for 2006, the most recent available.

Commonwealth Transportation Funding Sources

The multi-agency transportation administration in existence in the Commonwealth prior to November 2009 required the use of multiple sources to construct the "major" components of freight funding and how funds were distributed. These funding sources were identified using the Federal Highway Administration (FHWA) Highway Statistics Series 2000 through 2007, the Commonwealth of Massachusetts Comprehensive Financial Report (CAFR) 2008, the Commonwealth‟s 2008 Budget Appropriations, and other sources. Sources of funding include federal grants and appropriations programs, and revenue collections from motor fuels taxes, registrations, and tolls. The information in these reports was used to compile an assessment of total funding available to the Commonwealth of Massachusetts for funding transportation.

Motor Fuels

The Highway Transportation Fund is the primary source of MassDOT‟s funding. The Highway Transportation Fund revenue is generated directly from motor fuel tax collections, which was $576.1 million in 2008.

The Massachusetts motor fuel tax rate is $0.21 per gallon for gasoline and special fuels.[12] This rate has been fixed since 1991, and fuel tax revenues have remained relatively flat from 2000 through 2008 for two reasons. First, the motor fuel tax rate of 21 cents per gallon is not adjusted for inflation or fuel cost. Second, there has been only a small degree of variation in motor fuel consumption throughout the period.

[12] Kerosene and diesel are included as taxable as special use fuel products.

Private and commercial use highway consumption of gasoline represents the majority of taxed motor fuel volumes. Specifically, gasoline sales constitute approximately 90 percent of fuel tax revenues with 98 percent coming from highway use. Special fuels, which includes diesel, comprise 12 percent of total annual motor fuel tax revenues. In 2006, commercial use accounted for 13 percent of all motor fuel tax revenue. For FY 2008, the motor fuel tax revenue collected was $672.6 million, which was a 0.5 percent reduction from the motor fuel tax collection for 2007.[13]

The distribution of motor fuel revenues is shown in Table 2.

Table 2: Motor Fuel Tax Receipts Distribution ($Thousands)

	2000	2001	2002	2003	2004	2005	2006
Receipts Available for Distribution	$644,368	$652,182	$658,093	$667,722	$683,270	$685,846	$670,346
Highway	$643,104	$583,806	$652,214	$662,316	$573,328	$671,498	$173,713
Collection	-	$6,243	$5,879	$5,406	$6,222	$5,939	$6,470
Mass Transit	-	$62,133	-	-	$89,272	-	$490,163
State General Fund	$1,264	-	-	-	$14,448	$8,409	-

Source: Federal Highway Administration

Registrations and Fees

Transportation funding also comes from registrations and fees, which include:

- Vehicle registrations;
- Licenses;
- Certificates of title;
- Fines and penalties;
- Special licenses and franchise fees; and
- Certificates of permit fees.

Total registration and fee receipts for Massachusetts in 2007 were $202 million, growing to over $328 million in 2008. Vehicle registration fees for trucks and autos represent 50 percent of the budget as seen in Table 3.

Table 3: Registrations and Fees by Source ($Thousands), 2007

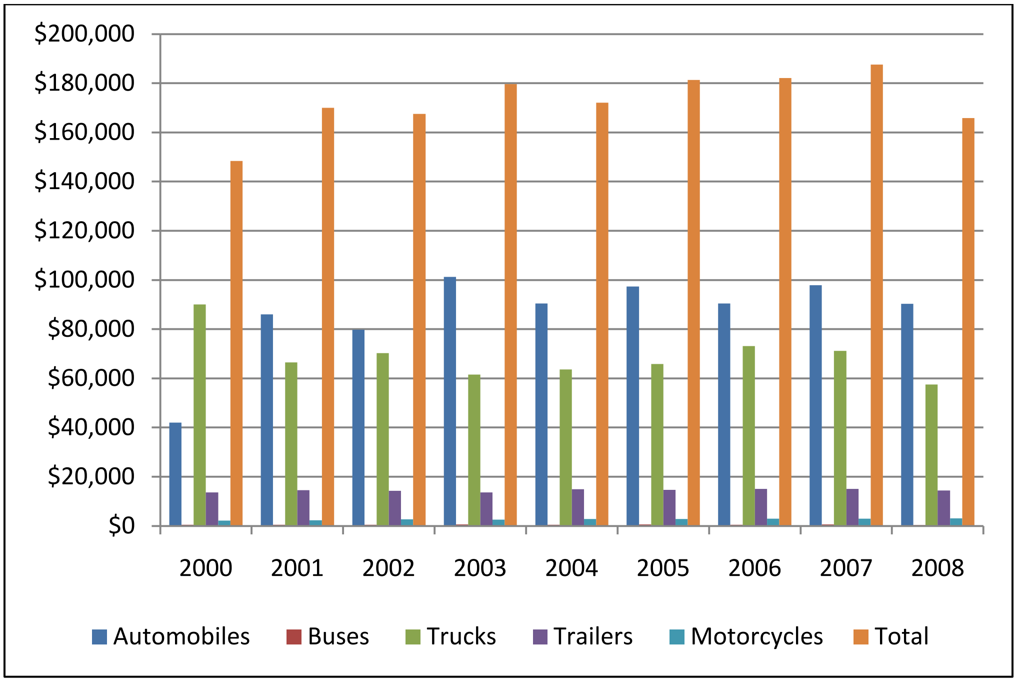
	2008	Percent Share
Registration Fees: Auto & Motorcycles	93,474	28%
Registration Fees: Buses, Trucks, Tractors, & Trailers	72,333	22%
Drivers Licenses	58,180	18%
Certificates of Title Fees	55,326	17%
Fines and Penalties	3,129	1%
Special Licenses, Franchise Fees, & Certificates of Permits	46,493	14%
Total Registration Fees	**328,935**	

Source: Federal Highway Administration

[13] Massachusetts Department of Revenue: Annual Report FY2008.

After registrations, certificates of title and licensing fees are the next largest category of collections. The breakdown of registration fees by vehicle type for Massachusetts is shown in Figure 7. The total truck registration fees collected has decreased slightly from 2000 levels. Fees for trailers have remained roughly the same over the past six years.

Figure 7: Commonwealth Registration Fees by Vehicle Type ($Thousands)

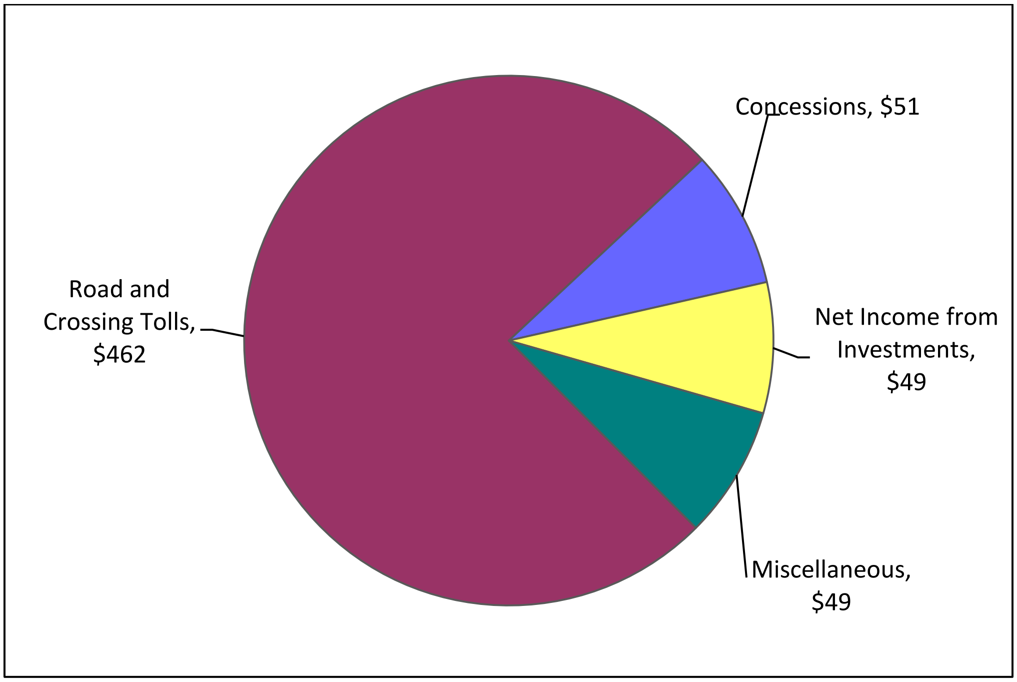


Source: Federal Highway Administration

Tolls Road and Crossing Facilities Fees

Toll revenues are used to cover: capital outlays, maintenance, operations, administration, highway law enforcement, and bond finance. Total road and crossing toll revenues available for disbursement in 2008 were approximately $611 million. The distribution of total tolls collected is shown in Figure 8. They include road and crossing tolls, concessions, and applicable miscellaneous fees. Road crossing and tolls is the largest revenue category accounting for 76 percent of all revenue, with the remaining categories accounting for 8 percent each. The majority of toll revenues available for distribution are usually set for the highway purposes. After 2002, however, roughly four to six percent of toll revenues were made available to the state general fund.

Figure 8: Commonwealth Toll Collection Distribution



Source: Federal Highway Administration

Sales Tax

The Forward Funding legislation passed by the Massachusetts legislature in 2000, allows the MBTA and other transportation authorities to receive a dedicated revenue stream from the state. Through this legislation the MBTA was allocated a dedicated 20 percent of the total annual sales tax receipts and the ability to issue its own debt. In FY 2008, the sales tax revenue allocated to the MBTA accounted for 53.7 percent of the agency"s total revenue collection. Despite annual ridership increases, the MBTA is still operating on a deficit largely due to sales tax revenues falling short of projections. Overall sales tax collections have shown little or no growth since 2006.

In response to this, the Massachusetts Legislature passed a sales tax increase to generate additional revenue for the Commonwealth and MBTA. The sales tax rate in Massachusetts changed from five percent to 6.25 percent effective August 1, 2009.[14] The rate change was also accompanied by changes in tax exceptions for certain goods, which together should generate additional revenue.

5.1.2 FREIGHT FUNDING PROGRAMS

Freight infrastructure funding comes from a variety of federal, state and private sources. These programs include grants, loans, and innovative financing solutions like Public Private Partnerships (PPP). Some quasi-public transportation agencies in the Commonwealth have other sources of funds available, such as fees collected for air, seaport, and passenger rail obtained via advertisements, tolls, ticket fares, parking, and leases to private companies.

[14] Massachusetts Department of Revenue.

In general, each transportation investment program makes funds available for land acquisition, maintenance, rehabilitation, and/or construction of infrastructure. Participating entities typically have to match a certain level of funding and demonstrate that there are sufficient social and transportation system benefits to justify the use of public funds.

5.1.2.1 Federal and State Transportation Improvement Plan (STIP)

Federal programs typically have the most funds available for a variety of capital improvements. The pool of applicants for discretionary federal funds is generally larger, however, and projects from across the country compete heavily for a finite amount of funds.

The State Transportation Improvement Plan (STIP) is a capital improvement program that is composed of 13 separate regional Transportation Improvement Programs (TIPs). The TIPs are prepared each year by the 10 Metropolitan Planning Organizations (MPOs) and three non-MPOs in Massachusetts. The STIP is a list of priority transportation projects for highway and transit, which are reviewed by state and federal agencies for funding. The STIP funding summary for proposed 2009 projects is presented in Table 4.

Table 4: STIP Listing of Proposed FY2009 Projects ($Millions)

	TOTAL	FEDERAL	Non-FEDERAL
Bridge	$231.7	$132.8	$98.9
Congestion Mitigation/Air Quality	$55.5	$44.5	$11.1
Federal Aid/Discretionary	$118.8	$98.4	$20.6
Interstate Maintenance	$75.5	$67.9	$7.5
National Highway System	$35.7	$100.3	$25.01
Surface Transportation Program	$256.0	$204.8	$51.0
Non-Federal Aid	$15.0	$0	$15
Planning	$18.8	$15	$3.7
Total	**$807.2**	**$663.7**	**$233.1**

Source: MassDOT STIP

5.1.2.2 GARVEE Bonds

Grant Anticipation Revenue Vehicles (GARVEEs), allow states to issue debt backed by future federal-aid highway revenues. Eligibility for freight projects is constrained by the underlying federal-aid highway programs that will be used to repay debt service. GARVEE bonds have been used in rail construction for various states, including vertical clearance projects for Amtrak. GARVEE bonds allow states to "reserve," or program, future annual highway dollars in order to complete near-term projects.

5.1.2.3 SAFETEA-LU

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) is the current federal surface transportation authorization act. SAFETEA-LU continues many of the policies and programs that originated in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21). SAFETEA-LU authorized the federal surface transportation programs for highways, highway safety and transit through September 30, 2009. The US Congress has yet to advance a new authorization bill. In March 2010, President Obama signed the HIRE Act, which extends current transportation law until December 31, 2010, and restores $19.5 billion in interest to the Highway Trust Fund.[15]

SAFETEA-LU includes the trademark of flexibility that has characterized the three most recent authorization acts. This flexibility enables the states and MPOs to use various federal funding programs for rail projects. These programs are summarized in Table 5.

Table 5: SAFETEA-LU Funding Sources for Rail Projects

Federal Funding Programs	Source	Type of Funding
Transportation Infrastructure Finance and Innovation Act (TIFIA)	US DOT - Appropriations	Federal Credit Assistance - Loans and Loan Guarantees
Railroad Rehabilitation and Improvement Financing (RRIF) Program	US DOT - Appropriations	Federal Credit Assistance - Loans and Loan Guarantees
Highway-Rail Crossing Program	Highway Trust Fund	Formula distribution to states
Rail Line Relocation and Improvement Capital Grant Program	Federal Railroad Administration (FRA) Appropriations	Grant Program
Local Freight Assistance (LFRA)	(Not currently funded)	Grant and Loan Program
Projects of National and Regional Significance (PNRS) Program	Title 23 U.S. Code Highway Trust Fund	Grant Program
Freight Intermodal Distribution Pilot Grant Program	Federal Highway Administration (FWHA)	Grant Program
Community Facilities Program	Federal Railroad Administration (FRA)	Loan, Loan Guarantees, and Grant Program
National Highway System	May fund rail projects related to highway construction	Grants (90/10)
Surface Transportation Program	May fund highway projects to accommodate railroad operations	Formula distribution to states

5.1.2.4 American Recovery and Reinvestment Act (ARRA)

To help stimulate the economy amidst the current economic downturn, the American Recovery and Reinvestment Act of 2009 (ARRA) was constructed to create and save jobs and stimulate economic activity, while improving the nation‟s infrastructure through funding “shovel ready” infrastructure projects. ARRA provided $311 billion in appropriations, of which transportation infrastructure received $48 billion. These funds also assisted state and local governments with budget shortfalls during the economic crisis. The following is a break down of the total federal funds available via ARRA for transportation projects:

- $27.5 billion for highway investments;
- $8.4 billion for investments in public transportation;
- $1.5 billion for competitive grants to state and local governments;
- $1.3 billion for investments in the air transportation system; and
- $9.3 billion for investments in rail transportation, including Amtrak, High Speed and Intercity Rail.

Efforts have been made by the current administration to prioritize rail. ARRA funds were made available to support the Federal Railroad Administration‟s High Speed Intercity Passenger Rail

[15] http://t4america.org/tag/safetea-lu/

(HSIPR) program, as well as the US Department of Transportation"s Transportation Investments Generating Economic Recovery (TIGER) grant program.

Although rail projects are explicitly stated within the stimulus legislation and guidelines for various investment categories, funds allocated for "highway" could also be flexed into projects for both passenger and freight rail. Although there were no funds directly dedicated for *freight* rail in ARRA, freight rail was eligible to tap into the following funds:

- $27.5 billion allocated for "highway" could have been flexed by state DOTs and MPOs to fund freight and passenger rail;
- The $1.5 billion TIGER surface transportation infrastructure discretionary grants program could be used for freight rail; and
- The $8 billion HSIPR funds could provide indirect benefits to rail networks.

Of note, some of the largest funded projects through the TIGER program were freight rail initiatives such as $105 million for the Norfolk Southern Crescent Corridor intermodal facilities in Alabama and Tennessee, $100 million for the CREATE project in the Chicago metropolitan area, and $98 million for the CSX National Gateway double-stack clearance project in Ohio, Pennsylvania, West Virginia, and Maryland.

South Coast Rail Bridges TIGER Project – Massachusetts was awarded TIGER Discretionary funds to reconstruct three structurally-deficient bridges immediately north of the planned Whale"s Tooth Station in New Bedford for the South Coast Rail project. The bridge work will cost $20 million and is the first step in the "Fast Track New Bedford" project that will help revitalize New Bedford"s waterfront and initiate construction of a key component of South Coast Rail. The most immediate benefit of this project will be to the freight rail shipments from the port and other local area freight rail customers.

Knowledge Corridor – The Federal Railroad Administration awarded MassDOT $70 million in the first round of the competitive HSIPR Program to rehabilitate 49 miles of track and construct two stations for the Vermonter train service in Western Massachusetts. This project is complemented by others in Connecticut and Vermont that will improve service on the entire New Haven - St Albans corridor. Pan Am Southern will rehabilitate the line for passenger operation with oversight provided by the MBTA Design and Construction Department. Service is expected to begin in October 2012 and this project will also benefit freight rail shipped on this corridor in Massachusetts and into Connecticut.

Wachusett TIGER Project – The Fitchburg Commuter Rail Line will also benefit from the $55.5 million Transportation Investment Generating Economic Recovery Funded Wachusett Commuter Rail Extension Project which will extend passenger rail service approximately 4.5 miles west of the Fitchburg commuter rail station, construct a new "Wachusett Station" and a new MBTA layover facility.

Fitchburg Commuter Rail Improvement Project – Through the Commonwealth"s formula based allocation of ARRA funds, Massachusetts has been enabled to implement Fitchburg Line improvements. This is a $199.2 million project for Fitchburg Commuter Rail Line interlocking work, double-tracking, and other improvements. It used a $10.2 million ARRA investment to fund the first stage of the Fitchburg Commuter Rail Improvement Project; an additional $39 million in ARRA funding for double-tracking; and $150 million in New Starts funding to support installation of new switches and signals as well as two new renovated stations and the reconstruction of existing track on the Commonwealth's oldest commuter rail line.

5.1.2.5 Surface Transportation Program

Surface Transportation Program (STP) funds may be used for highway improvements to accommodate rail line operations (clearances, grade separations), as well as for railroad relocations and consolidations, intermodal terminals and the acquisition of abandoned railroad rights-of-way. STP funds are often used by states to supplement the Section 130 grade crossing funds.

5.1.2.6 State Infrastructure Bank (SIB)

The National Highway System Designation Act of 1995 (Section 350) prompted the creation of State Infrastructure Banks by allowing states to set aside up to 10 percent of their federal transportation funding for public-private investments. State Infrastructure Banks may offer loan and credit options to help finance infrastructure projects. Funds are available for: land acquisition, multimodal facilities, and other infrastructure improvements. Money for projects may be loaned at low rates to private investors or may serve as capital reserve for bond and debt financing. The loan may be repaid with revenues generated by the project.

The program has been used in several states to seed revolving loan programs for private railroad improvement projects. By example, the Washington State Rail Bank funds small capital rail projects that improve freight movement by providing interest-free loans of up to $250,000. These interest-free loans must be matched by at least 20 percent of funds from other sources. Typical projects are strategic multimodal centers; purchases of rolling stock; improvements to terminals, yards, wharves, or docks; communication operating system improvements; siding track, rail grading, tunnel bore improvements; and bridges, trestles, culverts and other elevated or submerged structures.[16] Pennsylvania"s Infrastructure Bank grants loans at one-half the prime lending rate for up to 10 years for all types of transportation infrastructure projects. Borrowers can be municipalities, counties, transportation authorities, economic development agencies, non-profit organizations, and private corporations.[17]

5.1.2.7 Congestion Mitigation and Air Quality Improvement (CMAQ)

The Congestion Mitigation and Air Quality Improvement program funds projects that may reduce highway traffic congestion and help meet federal Clean Air Act requirements. CMAQ funding may be used for freight and passenger rail projects that accomplish CMAQ goals, which are to reduce emissions in nonattainment and maintenance areas. Funding is available for projects in areas that do not meet the National Ambient Air Quality Standards designated as nonattainment areas, in former nonattainment areas now in compliance for maintenance areas, and for projects outside air quality non-attainment areas where the air quality benefits of the project accrue to the non-attainment area or maintenance area. Massachusetts qualifies as a non-attainment area. CMAQ funds have been used to help fund the operations of passenger rail services for both commuter or intercity. For example, CMAQ funds have been used by Maine to fund operations of the Downeaster rail service. CMAQ funding could be explored for use for freight-related projects but this is a less traditional application of this funding mechanism.

5.1.2.8 Transportation Bond Bill Investment

The $3.5 billion Commonwealth Transportation Bond Bill was enacted in April of 2008, which authorizes spending for a range of capital projects within the Commonwealth. It includes $1.8

[16] "Freight Rail Investment Bank Program Application Packet," Washington State Department of Transportation (WSDOT).
[17] Pennsylvania Infrastructure Bank," http://www.dot.state.pa.us/penndot/bureaus/pib.nsf/homepagepib?readform

billion in federal matching dollars for rebuilding roads and bridges over a three-year period. The bill allocates $700 million to the State Implementation Plan for air quality attainment through funding public transit related projects including the Fairmount Commuter Rail Line, Green Line extension to Somerville and Medford, design and engineering for a Red Line-Blue Line connector, and additional transit oriented investments.

An additional $10 million for mass transit planning projects that support economic growth and promote geographic equity, including planning efforts for the South Coast Rail extension to Fall River and New Bedford, the Urban Ring project, and the Blue Line extension to Lynn. Lastly, the bill provides $8 million, matched with $8 million in federal funds, for the initial improvements to the Fitchburg Commuter Rail Line, delivering shorter trip times.

5.1.2.9 Accelerated Bridge Program

In August 2008, Governor Patrick signed legislation creating the Accelerated Bridge Program (ABP).[18] This program will provide nearly $3 billion in funding over the next eight years. The goal of the program is to improve the condition of bridges throughout the Commonwealth.[19]

The ABP will greatly reduce the number of structurally deficient bridges in the Commonwealth system and generate economic benefits. The program will repair or replace 300 structurally-deficient bridges in Massachusetts. It is expected that accelerated bridge repair will save an estimated one billion dollars in avoided cost inflation and another $500 million in avoided deferred maintenance costs.[20]

The ABP will be financed using $1.1 billion in grant anticipation notes, and $1.9 billion in gas tax bonds. A centerpiece of the project will be managing resources and costs, with a Commonwealth goal of 90 percent of projects delivered on time and budget. ABP will save Massachusetts money by repairing bridges before further costly deterioration can occur, hedging against construction cost inflation, using innovative construction contracting techniques (e.g. design-build), implementing preservation strategies, and becoming transparent with frequent detailed reports to control cost and adhere to project schedules and budgets.[21]

5.1.2.10 Massachusetts Opportunity Relocation and Expansion Program (MORE)

The Massachusetts Opportunity Relocation and Expansion (MORE) program is a capital grant program providing funds for public infrastructure improvements that will support business expansion within the Commonwealth.[22] Businesses need to meet certain requirements and apply for the grants. Grants can be used for publicly owned infrastructure only. The site acquisition costs and initial environmental assessments are not eligible for funding. Grant awards are made on a competitive basis at least once a year. Project requirements include:

- Creation of at least 100 net new jobs within Massachusetts;
- Maintenance of new jobs for at least 5 years;
- Generation of substantial sales from out of state; and
- Certification of available private funds for project completion.

[18] Ibid
[19] Mass Highway Department"s "Scorecard," February 2009.
[20] Mass Highway Department.
[21] "Accelerated Bridge Program Update", Mass Highway Department, December 2008.
[22] "Massachusetts Opportunity Relocation and Expansion (MORE) Jobs Capital Program: 2009 Program Guidelines," Executive Office of Economic Development.

5.1.2.11 Public Works Economic Development Program

The Public Works Economic Development (PWED) Program was created by the legislature to assist municipalities in funding transportation infrastructure for the purpose of stimulating economic development. The PWED regulations (7.01 CMR 5.00 et seq.) are "designed to provide eligible municipalities with maximum flexibility and discretion as it relates to project development and implementation" (701 CMR 5.01), but vest in the Secretary of Transportation the responsibility for evaluating and selecting eligible projects that will facilitate economic growth consistent with applicable Commonwealth policies (701 CMR 5.10).

5.1.3 HIGHWAY FREIGHT FUNDING

The following funding programs are focused specifically on highways.

5.1.3.1 The Interstate Maintenance (IM) Program

The annual IM Program is comprised of several projects on interstate highways totaling approximately $75 million. Each year, the projects are selected after a careful analysis of measured pavement condition and expected deterioration using sophisticated pavement management computer models. Emphasis is placed on utilizing optimal pavement preservation techniques applied at the right time during the pavement life cycle to minimize total cost. In addition to pavement preservation, each of the IM projects includes improvements to other highway features such as bridges, guardrail, and drainage systems so that all the work on a particular portion of road is done at the same time, minimizing traffic impacts.

5.1.3.2 NHS Preservation Program

This MassDOT program is composed of projects on the National Highway System (NHS) totaling $15 million. Pavement condition is a critical issue for freight because trucks do have disproportionately large impacts on pavement condition but also benefit from better pavement conditions through reduced vehicle costs for repairs and improved travel efficiency.

5.1.4 FREIGHT RAIL FUNDING

Rail funding typically comes from a variety of sources, including federal, state, and private interests. Some Commonwealth funding is available for rail improvements, but most freight rail investment remains private. Privately-owned freight rail service providers generally finance rail improvements through a combination of current cash flow or bond and stock issuances. For example, BNSF is a publicly-owned railroad company with stockholders. Warren Buffett and Berkshire Hathaway recently made a $34 billion stock purchase of BNSF. Their investment decision-making is based on expectations of future demand, revenue and costs of improvements. The private ownership structure of freight railroads, combined with the fact that there are restrictions on using public funds for privately-owned infrastructure in Massachusetts, means that freight rail projects have not traditionally been funded by public resources.[23] As a result, alternative sources of funding must be, and have been, pursued.

In addition, careful multi-modal planning and design can be a means to integrate rail and other modes of transportation by making designated non-rail funds available for freight projects. By example, a highway bridge improvement project that crosses a rail line can provide clearance improvements as a secondary benefit of the primary project. Despite the lack of a *consistent* funding stream for rail projects, there are numerous state and federal funding opportunities available for rail projects.

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[23] Freight Transportation: Strategies Needed to Address Planning and Financing Limitations, prepared by the General Accounting Office (GAO), December 2003.

5.1.4.1 Federal Funding Programs Available for Freight Rail

Many rail projects have utilized the CMAQ, and the Rail-Highway Crossing (i.e., Section 130) programs. This funding is channeled to the states through U.S. Department of Transportation (DOT) agencies such as the Federal Railroad Administration (FRA).

Credit Assistance Programs

Current federal law provides two credit assistance, direct loan and loan guarantee programs available for rail investments described below.

Rail Rehabilitation and Improvement Financing (RRIF)

This program enables US DOT to make direct loans and loan guarantees to state and local governments, government sponsored authorities and corporations, and railroads and joint ventures that include at least one railroad. Eligible projects include:

1. Acquisition, improvement or rehabilitation of intermodal or rail equipment or facilities (including tracks, components of tracks, bridges, yards, buildings and shops);
2. Refinancing outstanding debt incurred for these purposes; or
3. Development or establishment of new intermodal or railroad facilities.

The FRA can authorize direct loans and loan guarantees up to $35 billion and up to $7 billion for projects benefiting non-Class I carrier freight railroads. Twenty-two loan agreements have been granted since 2002, totaling more than $778 million. The loans can fund up to one hundred percent of a railroad project with a repayment period of up to 25 years and interest rates equal to the cost of borrowing to the government.

Transportation Infrastructure Finance and Innovation Act (TIFIA)

TIFIA authorizes credit assistance on flexible terms directly to public-private sponsors of major surface transportation projects of national significance to assist in gaining access to private capital markets. It can provide direct loans, loan guarantees, and lines of credit to support up to 33 percent of a project's cost. TIFIA is restricted to projects costing at least $50 million, with the exception of projects for Intelligent Transportation System (ITS) projects, which must cost at least $15 million.

Capital Grants for Rail Line Relocation Projects

Congress authorized Section 9002 of SAFETEA-LU at $350 million per year for fiscal years 2006 through 2009 for the purpose of funding a grant program to provide financial assistance for local rail line relocation and improvement projects. Congress did not appropriate any funding for this program until FY 2008. The final rule to implement this program was published on July 11, 2008.

States are eligible to apply for grants for construction projects that improve the route or structure of a rail line and 1) involve a lateral or vertical relocation of any portion of the rail line, or 2) is carried out for the purpose of mitigating the effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, or economic development. States or other eligible entities are required to pay at least 10 percent of the cost of the project. The state or FRA may also seek financial contributions from private entities benefiting from the rail line relocation or improvement project.

Short Line Railroad Tax Credit

The American Jobs Creation Act of 2004 included a provision to provide tax credits to help regional and short line railroads fund their infrastructure projects (45G. Railroad track maintenance credit). The credit is for fifty percent of the qualified railroad track maintenance expenditures paid or incurred by an eligible taxpayer during the taxable year with a limit equivalent to $3,500 per mile. The credit applies to any expenses paid or incurred after December 31, 2004, and before January 1, 2010. The tax credit was extended through 2010 but federal legislation is pending in the current Congress to extend this tax credit program through 2012, and to increase the credit cap to $4,500 per mile. Expenditures that qualify for the credit include gross expenditures for maintaining railroad track, which includes roadbed, bridges, and related track structures, that are owned or leased as of January 1, 2005, by a Class II or Class III railroad. Shortline operators have identified this tax credit a critical component for continuation or improvement of their operations.

Rail Safety Improvement Act of 2008

The Rail Safety Improvement Act of 2008 Requires Class I railroads, intercity, and commuter railroads to develop safety programs. The Act provides Railroad Safety Infrastructure improvement grants for eligible railroads, states and local governments. The legislation provides $1.6 billion for rail safety for FY 2009 through FY 2013. The bill also authorizes $250 million in “Rail Road Safety Technology Grants.” All grants and funds will require a 20 percent state match, but priority will be given to projects that seek less than the full 80 percent. For projects to be eligible, they must be in the Commonwealth‟s Rail Plan, and five percent of the funds are reserved for projects of less than $2 million.

5.1.4.2 Commonwealth of Massachusetts Funding Programs Available for Freight Rail

Massachusetts funding programs are often targeted at critical Commonwealth infrastructure, preservation of freight infrastructure, and often part of economic development initiatives. Many states have developed programs providing loans and in some cases grants to parties whose activities facilitate improvements to the freight transportation network, particularly to improving freight rail transportation. Often the programs offer reduced interest rates, or other incentives for those projects that improve the infrastructure, enhance economic development related to freight movement, or help maintain and improve the competitiveness and viability of rail as a means of freight transportation. The following programs are currently active in Massachusetts.

MassDOT’s Freight Rail Grant Program

Eligible freight rail projects include are limited to regional or municipal/local public entities. Awards are not made to private parties. A proponent's support for a freight rail project must be financial as well as functional. If a proponent is to be a public/private or public/public partnership, the project proponent shall outline the terms of the partnership, including the value of the parties' respective contributions and the effect, if any, on the public applicant's continuing control of the project. The program may have applicability to passenger rail interests when shared use rights-of-way or facilities are involved.

Capital Funding, Freight Rail Funding Program

This Capital Funding Program was developed by MassDOT to assist public entities in securing and using Commonwealth bond funds to fund freight rail improvements. Only public entities are eligible to receive funds from the Capital Funding Program. For a project to be deemed eligible, the proposal must demonstrate a sustained public benefit sufficient to warrant the use of public funds. Additionally, funds can only be used for infrastructure/capital investments and cannot be applied as operating funds. In certain cases, public private partnerships are permissible if the public applicant is the controlling partner.

Highway-Rail Grade Crossings

MassDOT Highway Division manages the Section 130 Highway-Rail Grade Crossing Program as established by the Highway Safety Act of 1973 (23 USC 130). The goal of the Section 130 program is to provide federal financial support in efforts to reduce the incidence of accidents, injuries and fatalities at public rail-highway crossings. States may utilize the Section 130 program, administered by the Federal Highway Administration, to improve railroad crossings using a variety of methods, including installation of warning devices, elimination of at grade crossings by grade separation, or by consolidation and closing of crossings. A portion of the safety program funding is also eligible for elimination of crossing hazards, should a state choose to use the funds for this purpose. Funds from other apportionment categories may also be used to improve crossing safety. For example, any repair, construction or reconstruction of roads and bridges affected by a project would be eligible under normal funding categories. A corridor approach to improving railroad crossing safety promotes greater efficiency in addressing these issues and has been encouraged by FHWA. The program has been used by both passenger and freight operators since its inception.

5.1.4.3 Rail Funding Programs in Other States

The following are a number of state programs that provide financing options for public and private rail initiatives. The vast majority of the loan and grant programs require a public benefit from the project to justify the use of public funds for rail investment. The major functions of these programs are to preserve existing infrastructure, assist capital improvement projects, and provide economic development.

Public-Private Partnerships

Several states have instituted policies and programs that encourage public private partnerships (PPP) to help leverage private investment into transportation infrastructure. There are two distinct forms of PPP arrangements: one where private entities lease public infrastructure and one where investment in infrastructure is shared by public and private entities, regardless of ownership.

There are a number of state and federal programs that have been created to make public funds available to private railroads. Although public funds will benefit the private sector, public investment comes with restrictions and eligibility requirements. Projects generally have to provide measurable economic benefits, require matching funds, and in the case of rail may require accommodation of additional passenger service. The following are examples of existing PPP arrangements:

- **Alameda Corridor –** This is a $2 billion 20-mile rail expressway connecting Ports of Los Angeles and Long Beach to rail yards near Los Angeles. The project has allowed for faster, more efficient freight flows.
- **Chicago Region Environmental and Transportation Efficiency Program (CREATE) –** This program is a partnership between the State of Illinois, City of Chicago, and the freight and passenger railroads. The program will upgrade track connections and expand routes, meaning faster connections and operations. The first stage of

construction is underway now at $330 million.[24] This program also received TIGER funds.

- **Heartland Corridor –** This project is a partnership between the Federal Highway Administration and a private railroad that will raise bridge and tunnel heights to allow double stacking between the East Coast and Chicago.
- **Texas PPP Legislation –** Recent legislation allows PPP agreements through Comprehensive Development Agreements (CDA) for project development and execution for transportation corridors with rail.
- **Virginia Department of Rail and Public Transportation –** This department accepts solicited and unsolicited proposals from private entities to construct, improve, maintain, and operate highways.
- **CSX Boston/Worcester Line –** The MBTA acquired the property rights of the Boston to Worcester rail line from CSXT, increasing the potential for additional commuter service. As part of this transaction, the Commonwealth and CSXT will increase the vertical clearances of bridges along the railroad main line between I-495 and the New York State line to accommodate double-stack freight trains. The Commonwealth will assume responsibility for raising highway bridges, while CSXT will be responsible for lowering tracks.

Partnerships allow private and public entities to pool resources together to make key infrastructure investments possible. For example, financing through public entities may allow for low interest loans that the private sector would not otherwise have access to, or key investments by both parties in land and rail could lead to improved access to intermodal/distribution facilities resulting in economic benefits.

The public sector has fairly limited experience with PPP arrangements and must be careful when defining contractual terms to ensure that private interests are not out-weighing those of the public. As of now, PPP agreements have yet to be standardized and vary for each project and program. Effective PPP should provide positive public and private benefits, and offer equitable cost sharing arrangements between the parties.[25]

Industrial Rail Access Program (IRAP)

An Industrial Rail Access Program (IRAP) is created to provide financial assistance to improve industrial access to rail. These programs aim to preserve freight rail service, stimulate economic development through new or expanded freight rail service, and increase the use of rail transportation.

An IRAP program would provide funding assistance for the construction or improvement of railroad tracks and facilities to serve industrial or commercial sites where freight rail service is currently needed, anticipated in the future, or in need of an upgrade. The funding program can allow financial assistance to localities, businesses and/or industries seeking to provide freight rail service between the site of an existing or proposed commercial facility and common carrier railroad tracks. It typically entails a partnership among the public sector, business owner, and railroad, which can all realized benefits from new or improved rail access.

Implementing an IRAP program would enhance industrial development opportunities and encourage freight shipment by rail to help reduce roadway congestion and emissions. The

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[24]"Working together: Public-Private Partnerships", Association of American Railroads (AAR), January 2009.

[25] "Devising an effective PPP Strategy – Point of View – Public Private Partnerships – Industry Overview" Railway Age, Resor and Blaze, Dec 2002.

program is a logical extension of existing Massachusetts programs to complement economic development such as the Public Works Economic Development (PWED) and the Massachusetts Opportunity Relocation Expansion (MORE) programs.

Massachusetts‟ current Freight Rail Funding Program is similar in many ways to an IRAP program except that the program‟s enabling legislation restricts private companies from using public funds for improvements. Despite its similarity in structure, it should be noted that the existing program has many existing financial obligations, and its funding is often restricted due to limits on the transportation bonding ability of the Commonwealth. By allowing private companies to use public funds through a new IRAP program, these funds could be greater utilized for improvements to privately-owned rail in Massachusetts, providing public benefits by boosting economic development opportunities and encouraging use of the rail system. In addition, enabling private companies to use public funds or enter into partnerships with public entities, would provide an opportunity to leverage private investment for rail infrastructure improvements. This would leverage more funding than would otherwise be available to help encourage additional investment.

IRAP programs are well-established in a number of states. Each state‟s IRAP type program varies in terms of budget and the percent of local and private funds that are required. Various IRAP programs by state are presented in Table 6.

Table 6: Industrial Rail Access Programs by State

State	Program Name	Match	Budget	Comments
Maine	Maine Industrial Rail Access Program (IRAP)	50% Minimum	$1 million total program (2007)	
New York	New York State DOT Industrial Access Program (IAP)		$1 million or 20% annual appropriation	60% Grant, 40% loan. Interest free 5 years
North Carolina	Rail Industrial Access Program	50% Minimum		Grant program
Pennsylvania	Pennsylvania Rail Freight Assistance Program (RFAP)	30% Minimum	$700k per project	$250,000 construction or 70%
Virginia	Virginia Rail Industrial Access Program (RIAP)	1 to 1 match above $300,000	$300,000 unmatched funds per project. No more than $450,000 to any one county, town, or city in one FY.	Funds cannot be more than 15% of recipients capital outlay
Wisconsin	Freight Rail Infrastructure Improvement Program		$3 million per project.	Loans require minimum of 2% annual interest

Source: “Financing Freight Improvements”, FHWA

For each program, eligible parties must apply for IRAP funds, and funds are awarded based on a number of criteria. For example, Maine‟s IRAP application process follows the former Local Rail Freight Assistance Program methodology created by the FRA, where projects are rated in ten separate categories:

1. Job creation;
2. New investment;
3. Intermodal efficiency;
4. Private share of cost;
5. Decrease in air emissions;
6. Decrease in highway maintenance costs;
7. Decrease in highway congestion;
8. Transportation and logistics savings;
9. Improvements in rail service; and
10. Project benefit-cost ratio.[26]

The requirement framework encourages improvements to rail infrastructure through competitive applications, and it results in funding assistance to projects with the greatest benefits.

A comparison of state IRAP Programs, infrastructure, and freight data is provided below in Table 7.

Table 7: IRAP Program Comparison

State	Miles Operated	Tons (thous)	Rail Budget (Mil$)	$/mile	$/ton
Vermont	568	9,993	$8.6	$15,070	$0.9
New York	3,622	76,717	$20.0	$5,522	$0.3
Maine	1,165	7,381	$2.1	$1,844	$0.3
Pennsylvania	5,095	208,979	$8.5	$1,668	$0.04
Virginia	3,223	174,935	$1.5	$465	$0.01
Massachusetts	1,079	17,942			

Source: "Financing Freight Improvements" FHWA, State DOTs, TRANSEARCH Database, FAF^2, and Calculations HDR

Preservation and Improvement

Preservation efforts for rail infrastructure can entail a number of actions by either public or private entities. Generally, preservation related projects include improvements and maintenance of existing lines, land acquisition, right-of-way, and rehabilitation of facilities. Most states evaluate potential projects based upon public benefits to safety and the economy, job creation/retention, improved service to industrial and agricultural customers, elimination of grade crossings and reductions in highway congestion. The following highlighted programs from other states provide grant or loan assistance for preservation and improvements to the existing rail infrastructure. The major rail and preservation programs by state are provided in Table 8.

[26] Maine Department of Transportation, http://www.maine.gov/mdot/freight/irap.php.

Table 8: Rail Preservation and Improvement Programs by State

State	Program Name	Program Details
Illinois	Rail Freight Program[27]	Funds provided by the IL General Fund and loan repayments to provide assistance to communities, railroads, and shippers. Funding comes in the form of low-interest loans and grants. .
Michigan	Rail Loan Assistance Program[28]	Provides no-interest loans up to $1 million to railroads, localities, EDC's, and freight rail users. Recipients must match 10% of project cost and demonstrate public benefits.
Mississippi	Local Government Revolving Loan Program[29]	Low interest loans up to 15 years at 1% less than Federal Reserve Discount Rate. Loans are from Mississippi Development Authority to counties or municipalities.
Ohio	Ohio Rail Development Commission[30]	Assists companies considering new rail infrastructure. Grants provided on basis of job creation/retention. Loans are 5 years with interest of 2/3 prime rate.
Virginia	Rail Preservation Grant Program[31]	Provides grants or loans for shortline operations. Funds require 30% match. Local gov't, authorities, agencies, and non-public sector are eligible. Loans only available to large railroads.
Wisconsin	Freight Railroad Preservation Program[32]	Grants for preservation and rehabilitation of publicly owned lines, purchase of abandoned lines. Grants account for 80%, and available to public agencies and private sector.

Source: HDR, based on information from Departments of Transportation

One of the larger preservation and improvement programs is the *Minnesota Rail Service Improvement Program,* which consists of five components that draw funds from the state general fund and general obligation bonds. The components are listed below:

- The Rail Line Rehabilitation Program, which provides low or no-interest loans for up to 70 percent of costs to railroads for the preservation and rehabilitation of rail lines.
- The Rail Purchase Assistance Program, which provides funds for the purchase of regional rail lines. Criteria to receive funding includes showing that the railroad can operate profitably, benefits exceed costs of purchase and rehabilitation, and that capable operators are available.
- The Rail User and Rail Carrier Loan guarantee Program, which guarantees up to 90 percent of loans to shippers and carriers for rail rehabilitation and capital improvements.
- The Capital Improvement Loans of up to the lesser of $200,000 or 100 percent of costs for facility improvements, track connections and loading, unloading and transfer facilities. The final component is the Rail Bank Program, which is used to acquire and preserve rail lines for future transportation needs.[33]

[27] "Financing Freight Improvements," FHWA, 2007.
[28] Ibid
[29] "Mississippi Freight Rail Service Projects Revolving Loan/Grant Program (RAIL) Guidelines," Mississippi Development Authority.
[30] "Financing Freight Improvements," FHWA, 2007; http://www.dot.state.oh.us/divisions/rail/Pages/default.aspx.
[31] Virginia Department of Rail and Public Transportation (DRPT), http://www.drpt.virginia.gov/activities/railfunding.aspx.
[32] "Freight Railroad Preservation Program Application Instructions," Wisconsin Department of Transportation, http://www.dot.wisconsin.gov/localgov/aid/frpp.htm.
[33] "Financing Freight Improvements," FHWA, 2007.

Tax Exemptions

Another method for leveraging private rail investments is tax exemptions. Through these arrangements, the cost of railroad infrastructure investment can be reduced for private companies, and the Commonwealth does not absorb the financial risk involved with the capital expenditures. Connecticut state law grants tax exemptions to qualifying passenger and freight railroads. Eligible railroads receive an exemption on gross earnings taxes for rail improvement and preservation projects the railroad undertakes. To be considered for the tax exemption, the projects must be railroad track or facility projects involving maintenance, rehabilitation or construction, or rehabilitation or acquisition of equipment that is used exclusively in Connecticut. Additionally, there are provisions for the preservation of light density freight lines where the revenue and variable cost of the line creates the potential for abandonment.

5.1.5 AIR CARGO FUNDING

There are two primary statewide entities involved in funding for Massachusetts airports, the Massachusetts Port Authority (Massport) and the Aeronautics Division of MassDOT, formerly the Massachusetts Aeronautics Commission (MAC).

Massport owns and operates three airports, Logan International, Hanscom Field, and Worcester Regional Airport. MassDOT oversees and regulates aviation at the Commonwealth‟s other 38 public-use airports.[34] Twenty-four airports are owned by municipalities and fall under the jurisdiction of the department, and 14 airports are privately owned. In addition, there are more than 200 private landing areas, seaplane bases and heliports.

Air cargo is transported in the belly of passenger aircraft or separately in all-cargo aircraft. Operations are funded privately by the airlines, but there are five major sources of airport capital development funding available:

- FAA Airport Improvement Program (AIP);
- Tax-exempt bonds;
- Passenger facility charges (PFCs);
- State and local grants; and
- Airport operating revenue.

Depending on an individual airport‟s financial situation and type of project being considered, different combinations of these sources of funds are used. Generally, small airports are more likely to be dependent on AIP grants than large- or medium-sized airports. The larger airports are also much more likely to participate in the tax-exempt bond market or finance capital development projects with a Passenger Facility Charges (PFC). Airport improvements are funded with the following formulas:

[34] Massachusetts Aeronautics Commission, "Massachusetts Port Authority Coordination and Efficiencies Report," http://www.eot.state.ma.us/downloads/chap196/MACreport.pdf.

- Federally funded
  - 95 percent federal
  - 2.5 percent state
  - 2.5 percent local
- State funded
  - 80 percent state
  - 20 percent local

The following section describes in detail the options available for airport capital improvements.

5.1.5.1 Federal Aviation Funding

Airport and Airway Trust Fund

The Airport and Airway Trust Fund (AATF), created by the Airport and Airway Revenue Act of 1970, provides funding to the nation"s aviation system through several aviation-related excise taxes. These include:

- Domestic passenger tax of 7.5 percent of ticket price;
- Per passenger per segment tax of $3.40 in CY2007 (flights to or from rural airports are exempt from the segment tax);
- Head tax assessed on passengers arriving to or departing from foreign destinations and U.S. territories that are not subject to the domestic passenger ticket tax, $15.10 for CY2007;
- Fuel taxes;
- International Facilities Tax, $7.50 for CY2007;
- Frequent Flyer Tax of 7.5 percent of value of miles; and
- Cargo and mail tax of 6.25 percent of amount paid for the transportation of property by air.[35]

AATF is the revenue source used to fund AIP projects, which offers grants to public agencies and, in some cases, to private owners and entities, for the planning and development of public-use airports that are included in the National Plan of Integrated Airport Systems (NPIAS). In Massachusetts, 26 airports are potentially eligible for AIP funding. Greater detail related to AIP is covered later in this section. In general, however, an AIP grant covers 75 percent of eligible costs (or 80 percent for noise program implementation) for large and medium primary hub airports. For small primary, reliever, and general aviation airports, the grant covers 95 percent of eligible costs.[36]

Airports Capital Improvement Plan

The national Airports Capital Improvement Plan (ACIP) is an internal FAA document that serves as the primary planning tool for identifying and prioritizing critical airport development and associated capital needs for the National Airspace System. It also serves as the basis for the distribution of grant funds under AIP.

[35] Federal Aviation Administration http://www.faa.gov/about/office_org/headquarters_offices/aep/aatf/media/Simplified_Tax_Table.xls

[36] Federal Aviation Administration, Airport Improvement Program, http://www.faa.gov/airports/aip/

The FAA AIP Branch prepares the national ACIP annually on the basis of nine Regional ACIPs. Each FAA Regional Airport Office prepares its Regional ACIP from information provided by individual airports or state airport planning agencies on anticipated development needs over the next three to five years.

Airport Improvement Program (AIP)

The AIP program provides federal grants to airports for airport development and planning. It was established by the Airport and Airway Improvement Act of 1982. It has been amended several times, most recently with the passage of the Century of Aviation Reauthorization Act (Vision 100). Funds obligated for the AIP are drawn from the Airport and Airway Trust fund, which is supported by user fees, fuel taxes, and other similar revenue sources.[37]

The 1982 Act, as amended, defined eligible airports into five categories:

- Commercial Service Airports;
- Primary Airports;
- Cargo Service Airports;
- Reliever Airports; and
- General Aviation Airports.

In Massachusetts, 28 airports are eligible to receive AIP funds from FAA.[38]

AIP funding is usually spent on projects that support aircraft operations including runways, taxiways, aprons, noise abatement, land purchase, and safety, emergency or snow removal equipment. Commercial revenue producing portions of terminals (such as shop concessions or commercial maintenance hangars), automobile parking garages, and off-airport road construction are examples of improvements that generally are not eligible for AIP funding. In addition, AIP cannot be used for airport operational expenses or bond repayments.[39]

The eligible and ineligible projects for AIP funding include runway and taxiway improvements or rehabilitation, land acquisition, and safety improvements. Along with the physical improvements AIP, funding can be provided for planning and environmental studies. AIP funds are not eligible for maintenance of equipment, vehicles, or aircraft hangars.

Airport sponsors who accept a grant offer are also accepting conditions and obligations associated with the grant assurances. These include obligations to operate and maintain the airport in a safe and serviceable condition, not grant exclusive rights, mitigate hazards to airspace, and use airport revenue properly.[40]

Because the demand for AIP funds exceeds the availability, there are specific guidelines for distribution of funds. AIP funds are typically first apportioned into major entitlement categories, primary, cargo, and general aviation. FAA then distributes entitlement funding for Commercial Service and Primary Airports based on the number of enplaned passengers using the airport. General Aviation (GA) Airports, including Reliever Airports, also receive their funding from the FAA, but individual states determine the distribution of funds based on a ceiling provided by the

[37] Federal Aviation Administration, http://www.faa.gov/airports/aip/overview/.
[38] MassDOT, http://www.eot.state.ma.us/mac/default.asp?pgid=AeroAbout&sid=level2.
[39] Federal Aviation Administration, Airport and Airway Trust Fund, http://www.faa.gov/about/office_org/headquarters_offices/aep/aatf/.
[40] Ibid

FAA.[41] Set-aside projects (airport noise and the Military Airport Program) receive first attention from the discretionary distribution of funds. The remaining funds are true discretionary funds that are distributed according to a national prioritization formula.

Funding of projects that qualify under the AIP is typically divided into three sources: federal, state and local. The federal share of most projects is 95 percent of the eligible cost to be reimbursed under the AIP. The remaining five percent is usually divided between the state and the local airport sponsor. In Massachusetts, the MAC currently funds 2.5 percent of the non-federal share of projects under AIP, thereby relieving the local airport sponsor from a significant financial burden, resulting in a contribution from the host community of only 2.5 percent of the total cost of a project.[42]

Passenger Facility Charge (PFC)

The Passenger Facility Charge Program allows the collection of PFC fees up to $4.50 for every enplaned passenger at commercial airports controlled by public agencies. Airports use these fees to fund FAA-approved projects that: enhance safety, security, or capacity; reduce noise; or increase air carrier competition.

The PFC is a local fee that can be imposed, with federal approval, by an airport on each boarding passenger. PFC funds can be used for a somewhat broader range of projects than AIP grants and are more likely to be used for "ground side" projects such as passenger terminal and ground access improvements. PFCs can also be used for bond repayments.

5.1.5.2 Commonwealth of Massachusetts Aviation Funding

The Aeronautics Division of MassDOT administers Commonwealth financing of its airports; inspects and licenses airports and landing pads; regulates airport security, safety, and navigation; and is responsible for statewide aviation planning. MassDOT does not own any airports.

Aviation funding in Massachusetts is managed out of the transportation budget of the general fund. Aviation funding comes from several sources:

- Fuel Taxes;
- $0.194/gal federal tax goes into the Capital Improvement Fund;
- $0.155/gal now goes into the General Fund; and
- Aircraft Registration Fees.

The funds flow into the transportation fund, and then flow out to aviation, highway, marine, and other transportation projects in the Commonwealth. Currently, there is no aviation set aside in the transportation fund.

In addition to the federal funding options described previously, a separate Commonwealth program, the Airport Safety and Maintenance Program (ASMP), is used in Massachusetts to leverage AIP funds for safety and maintenance projects that are not eligible for AIP assistance.[43] These projects may include private airports that are not eligible for federal funds; the Commonwealth program does not make a distinction between publicly- and privately-owned airports. Any public use airport is eligible for Commonwealth funding of improvement projects.

[41] Federal Aviation Administration, http://www.faa.gov/airports/aip/overview/
[42] http://www.eot.state.ma.us/mac/default.asp?pgid=FaaFunding&sid=level2.
[43] MassDOT, http://www.eot.state.ma.us/mac/default.asp?pgid=AeroAbout&sid=level2.

5.1.6 SEAPORT AND MARITIME FUNDING

The Maritime Administration (MARAD) is the agency within the U.S. Department of Transportation dealing with waterborne transportation. Its programs promote the use of waterborne transportation and the integration with other segments of the transportation system. Some federal and state funding is available for port projects, although many infrastructure projects are privately funded. Some elements of port infrastructure are more suited to public funds. For example, dredging is often provided by the U.S. Army Corps of Engineers, financed through the Harbor Maintenance Tax Trust Fund. A complete discussion of the public and private funding options for ports is provided in the following sections.

5.1.6.1 Federal Port Funding

Federal funding for ports comes from a variety of sources. There are federal funds available specifically for ports, but port infrastructure also benefits from other surface transportation funding opportunities. For example, if an access road is required at a port, funding may be requested through FHWA programs. Improved rail access could be funded through the FRA. This section focuses on those federal funding options exclusive to ports.

Port Security Grant Program

MARAD reviews dredging requests and Department of Homeland Security grant funding for ports. The Port Security Grant Program (PSGP) provides grant funding to port areas for the protection of critical port infrastructure from terrorism. For FY2010, $288 million has been made available to ports for security efforts. The funds are primarily intended to assist ports in "enhancing maritime domain awareness, enhancing risk management capabilities to prevent, detect, respond to and recover from attacks involving improvised explosive devices (IEDs), weapons of mass destruction (WMDs) and other non-conventional weapons, as well as training and exercises and Transportation Worker Identification Credential (TWIC) implementation."[44]

The Harbor Maintenance Tax

The Harbor Maintenance Tax (HMT) was created as a "fee" under the Water Resources Development Act of 1986. It was an ad valorem (value) tax assessed on goods imported and exported through most U.S. seaports. Specifically, the tax is assessed in all U.S. seaports that receive federal funding for maintenance dredging by the U.S. Army Corps of Engineers, unless exempted. In 1997, the U.S. Supreme Court struck down the Harbor Maintenance Fee on exports as unconstitutional, but the HMT on imports is currently in force.

Taxes collected through the HMT are accumulated in the Harbor Maintenance Tax Trust Fund, which is distributed by the Army Corps of Engineers for dredging projects in qualifying U.S. ports. The tax is assessed at 0.125 percent of the value of goods ($1.25 per $1,000). Currently, this fund has a surplus. Funds from the Army Corps of Engineers are often the principal federal funding resource provided to ports for dredging and channel maintenance projects as is required at Massachusetts ports.

The HMT is a particular burden for the Port of Boston, because Boston"s imports are typically of higher value than those at other US ports. The HMT burden per container is correspondingly greater on goods coming through the Port of Boston than at most other US ports, creating additional incentive for diverting shipments through Canada. As the closest major port to

[44] Port Security Grants Recovery Act Plan, May 15, 2009, http://www.dhs.gov/xlibrary/assets/recovery/FEMA_Port_Security_Grants_Recovery_Act_Plan_51509.pdf.

Canada, many New England shippers choose to pay additional trucking charges in order to route cargo via the Port of Montreal, where no HMT is assessed.

5.1.6.2 Commonwealth of Massachusetts Port Funding

As described in an earlier section, the Massachusetts Seaport Advisory Council is tasked with improving and developing the deep water commercial ports of the Commonwealth, with an emphasis on the commercial aspects of the ports. The intent of the Council initiative and the supporting funding is to give most attention to the four next tier ports, Gloucester, Salem, New Bedford and Fall River, in addition to the Port of Boston.[45] Using general obligation bonds as authorized by the Seaport Bond Bill, the Council has provided ports and harbors in the Commonwealth with more than $63 million for capital improvement projects since the signing of the Seaport Bond Bill.

The Seaport Advisory Council approved and authorized the $4.1 million Environmental Bond Bill to a wide array of seaport projects in September 2008. The approved seaport projects, project cost, and details can be found in Table 9.

Table 9: Approved Environmental Bond Bill Projects

City	Project Cost	Project Details
Chatham	$300,000	Fish Pier Float System
Dennis	$50,000	Dredge Sesuit Harbor
Gosnold	$320,000	Repairs to Town Pier-Fuel Dock Outthink Island
New Bedford/ Fairhaven	$300,000	Phase III Dredge Construction Additional Funds
New Bedford	$75,000	New Bedford Berth/Launch Facilities
Quincy	$350,000	Squantum Point Park Pier, Adams Landing Project
Salem	$2,300,000	New Salem Wharf Land Acquisition and Construction Documents
Scituate	$550,000	Marine Park Dredging
Wareham	$575,000	Besse Park Bulkhead Replacement
Statewide	$200,000	Statewide, Harbor Coordinators: Fall River, Gloucester, New Bedford and Salem

Private investments may also be utilized to fund port improvements.

5.1.7 FREIGHT FUNDING ISSUES

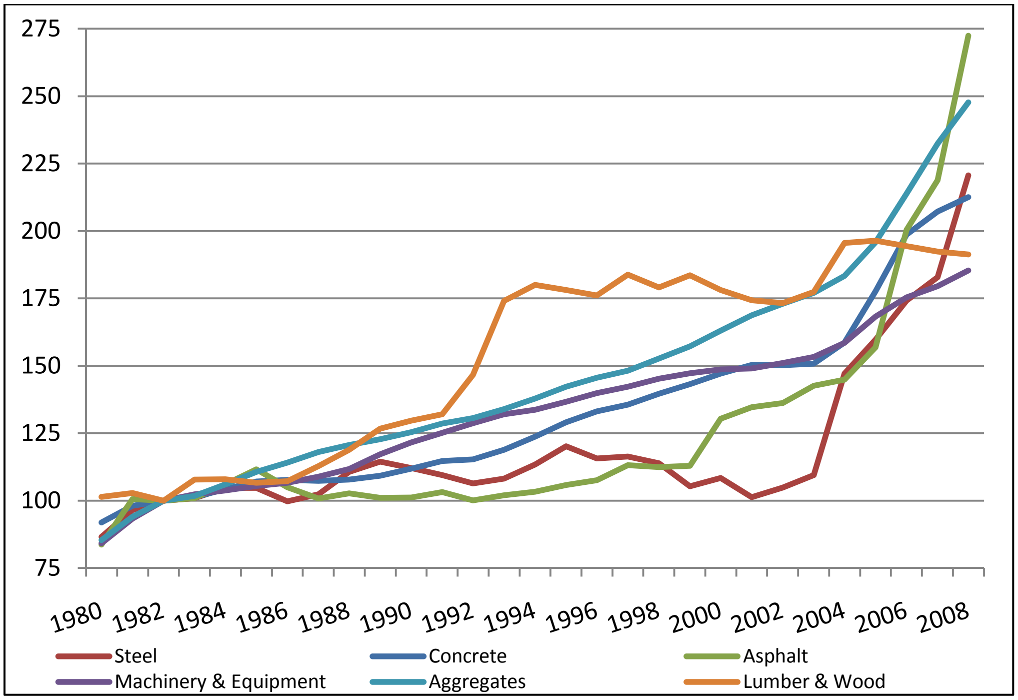
The general obstacles of transportation financing in Massachusetts are consistent with other transportation agencies. First and foremost, project cost escalation and completion costs need to be controlled and budgeted for properly. The Accelerated Bridge Program is an acknowledgement of the recent high cost escalation, as Massachusetts is trying to replace and rehabilitate 300 structurally deficient bridges in the next eight years, while delivering 90 percent on time and on budget through better project management and planning.

Prices of inputs used in construction have increased 30 percent from December 2003 to January 2008,[46] with street and highway construction increasing more than 40 percent. A large portion of these increases came in the form of increased fuel costs (primarily diesel) and steel,

[45] Massachusetts Seaport Advisory Council Presentation to the Regional Transportation Advisory Council, January 13, 2010. http://www.ctps.org/bostonmpo/5_meetings_and_events/2_past/2010/011310_RTAC_Materials.pdf.
[46] "AGC Construction Inflation Alert," March 2008.

as shown in Figure 9. In terms of labor costs, wages for construction have increased in the Commonwealth by 14 percent since 2000.[47] The combination of growing input and labor costs must be factored into any future capital planning.

Figure 9: National Producer Price Index for Construction Industries, 1980-2008



Source: Bureau of Labor Statistics

High operating costs associated with the transportation system also must be reduced. Current operations are exceeding allocated budgets, and deficits are being filled with bonded capital improvement funds. This approach results in two consequences: reduced funding for capital improvements and the incurring of interest when using bonded funds to pay for current operations. A large portion of these significant operating costs is related to high retirement compensation payments and high labor costs.

Historically, Massachusetts has encountered substantial policy and legal constraints on its ability to engage in true shared investment for shared benefit arrangements in the Commonwealth‟s rail network. However, MassDOT, with a strong legislative finding and specifically authorized program, similar to programs in other states, could broaden the range of potential rail investments that deliver public benefits to the Commonwealth.

5.1.8 FREIGHT FINANCING OPPORTUNITIES

A critical element of improving the Commonwealth‟s freight transportation infrastructure is determining practical and innovative mechanisms to finance improvements. From the analysis of funding means presented in the above sections, key opportunities to improve and expand freight financing opportunities are considered to be:

- Greater consideration of goods movement in funding allocations;

[47] Bureau of Labor Statistics: Occupational Employment Statistics.

- Strategic multi-modal investments in projects of statewide significance;
- Increased public-private partnership opportunities and funding;
- Creation of an industrial rail access program (IRAP); and
- Continued pursuit of competitive federal funding programs.

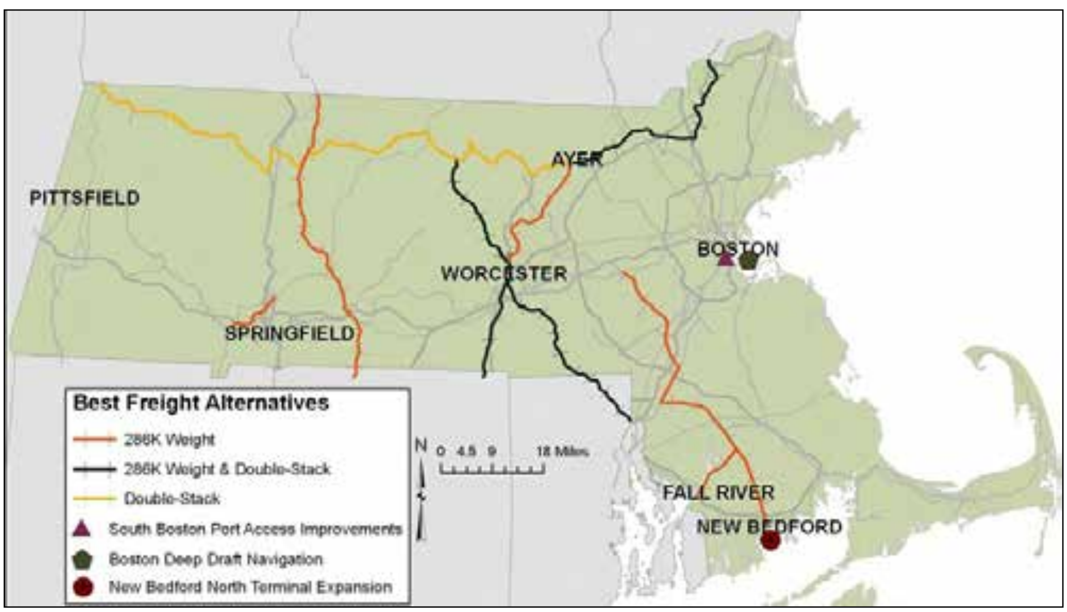
5.2 INVESTMENT AND POLICY RECOMMENDATIONS

The Freight Plan findings and recommendations are organized in terms of investment priorities with a high expected return on investment and policy issues and recommendations to support a more competitive freight system in Massachusetts.

5.2.1 FREIGHT INVESTMENT PRIORITIES – HIGH RETURN PROJECTS

For each of the previous scenarios, individual projects demonstrated strategic benefits paired with high return on investment (ROI). The projects from each scenario that are estimated to provide the best return on investment and strategic transportation advantages were have been identified. These multimodal projects enhance current freight service and capitalize on current infrastructure to facilitate network level efficiencies. The majority of these investments are centered on the rail network, improving both east-west movements and north-south connections. Rail improvements include both 286k weight-on-rail capacity and double-stack clearance improvements. Additionally, the expansion of New Bedford‟s north marine terminal and the deep draft dredging project for Boston Harbor are included, with additional landside improvements to the South Boston roadway network. The high return projects are shown in Figure 10 below.

Figure 10: Freight Investment Projects with the Highest Estimated Return on Investment



The freight projects with the highest estimated ROI are provided in Table 10.

Table 10: Highest Estimated ROI Projects

Project Name	Investment
Mechanicville to Ayer	Double-stack
Ayer to Maine	Double-stack & 286k
Worcester to Ayer	286k
PVRR Westfield to Holyoke	286k
NECR (VT border to CT border)	286k
P&W (Worcester Connections)	Double-stack & 286k
Framingham to Taunton (CSX)	286k
Taunton to NB & FR	286k
Boston Harbor	Deep Draft Dredging
South Boston Port Access	Road
New Bedford North Terminal Expansion	Harbor Freight Terminal

The total cost of the high ROI investments, in present value terms, is $402.9 million as shown in Table 11. Reduced shipping costs from transporting more freight by lower cost rail and water modes provide the largest benefits. These projects would enhance the competitiveness of the Massachusetts economy, reduce consumer costs to residents, and provide environmental benefits. These projects also provide significant roadway congestion benefits to both trucks and autos, resulting in reduced emissions and accident costs. Transportation and environmental benefits account for 10 percent of the total benefits. Other benefits include a $49.1 million reduction in highway maintenance costs, and $24.6 million in freight logistics benefits.

Table 11: High ROI Investment Projects Cost-Benefit Analysis Summary (2009 $Millions)

Cost-Benefit Results	
Shipper Cost Savings	$783.7
Truck Congestion Relief Benefits	$76.4
Freight Logistics Benefits	$24.6
Economic Benefits & Cost Savings	**$884.7**
Auto Congestion Relief Benefits	$28.9
Reduced Emissions	$5.9
Reduced Accidents	$14.5
Reduced Highway Maintenance and Repair	$49.1
Transportation & Environmental	**$98.3**
TOTAL BENEFITS	**$983.0**
Capital Costs	$393.3
O&M Costs	$9.6
TOTAL COSTS	**$402.9**
Net Present Value (NPV)	**$580.2**
Benefit-Cost Ratio	**2.4**

Source: HDR and EDR Group calculations

The overall estimated benefit-cost ratio is 2.4, a very strong return on investment. Of note, these benefit results are based on the assumption that diesel fuel prices escalate in-step with overall inflation growth. As discussed above, if fuel prices do increase faster than overall inflation, the benefits of these multi-modal freight investments are expected to be even higher, with greater diversion of future freight growth from truck to rail and water modes. The BCR for this higher fuel price condition would likely be between 2.7 and 3.0.

It is worth noting that approximately 90 percent of the estimated benefits would accrue to private sector economic activity as the transportation improvements reduce the costs and boost the efficiency of goods movement for freight shippers, receivers, and carriers. These impacts improve the economic competitiveness of Massachusetts businesses and contribute to a seamless, multi-modal system of global and domestic trade. Most of the improvements would occur on privately-owned rail infrastructure or at quasi-public seaports. These results highlight the importance of public-private partnerships to implement large-scale transportation improvements to benefit Massachusetts residents and businesses. The recent CSX rail transaction and Knowledge Corridor rail project provide good examples in Massachusetts of public-private partnerships on privately-owned rail lines.

These investment projects, expected to provide a range of benefits to Massachusetts, form a list of priority opportunities for MassDOT to pursue over the next five to ten years. Importantly, it is anticipated that the capital costs to implement these projects will come from a range of federal, state, and private resources. For example, the various freight rail investment present opportunities for public-private partnerships to undertake needed investments. It is anticipated that MassDOT will use the information in the Freight Plan to help guide policy formation and project priorities.

5.2.2 POLICY ISSUES AND RECOMMENDATIONS

A number of policy issues and recommendations have been identified in the areas of land use development, funding and financing, and the freight planning to best utilize the existing freight transportation system in the Commonwealth and to support potential investments.

5.2.2.1 Land Use Development

Freight movement takes place within a land use context where manufacturers and distributors of goods are located throughout Massachusetts in a variety of settings. These companies make market decisions regarding where to locate their facilities. Key considerations in these decisions are the availability of sites of the requisite size, the availability and quality of freight transportation, and proximity to markets and labor. The significant concern for freight-intensive uses is that other land uses that are not freight dependent often are considered a higher and better use for most developable land in Massachusetts. These other land uses tend to predominate in the real estate market and are typically the target of most economic development initiatives. In addition, freight-intensive uses have size and activity characteristics that are often perceived as incompatible with other land uses. The result of this combination of economic development focus and perceptions is that land served by rail and originally zoned for freight-intensive uses is being rezoned for other uses. The loss of land for freight-intensive uses results in increased shipping costs and reduced competitiveness for the Commonwealth"s economy.

The following items are specific recommendations for further development and action.

Freight-Intensive Land Use Policy

A policy on freight-intensive land uses should be adopted by MassDOT and the Executive Office of Housing and Economic Development that articulates the Commonwealth"s interest in preserving land for freight-intensive uses and developing parcels in a manner that does not foreclose rail access. This policy would define freight-intensive use and set forth criteria for determining if a parcel is of strategic importance for these uses. The policy and its criteria would be used to:

- Develop a statewide inventory to identify major parcels of strategic statewide importance suitable for intermodal centers, distribution/assembly centers, or freight villages, as well as in evaluating local industrial-incentive areas (described below) that are proposed by municipalities. As mentioned earlier, the current list of Priority Development Sites does not include any sites expected to include freight-intensive uses, and this action would thus create a limited number of strategic statewide sites for freight-intensive use.
- Explicitly include freight-intensive uses as eligible elements of Chapter 43D Priority Development Sites, and as qualifying uses under the Growth District Initiative. This could be addressed by having the Interagency Permitting Board under Chapter 43D make a simple revision to its guidelines to address freight-intensive use. Maintaining rail access would become a requirement for such parcels under both programs.

This policy would be considered in MEPA review in a manner similar to the Commonwealth"s 10 sustainable development principles and would be instrumental in pre-review under MEPA (described below). This aspect of the policy should be articulated through development guidelines for parcels with rail access. The guidelines could also be adopted by local planning boards as part of their subdivision regulations where applicable.

Statewide Inventory of Sites

In order to target specific sites for a freight-intensive use policy, MassDOT and EOHED in collaboration with its partners, including MassDevelopment and MassEcon, should identify sites of at least 10 acres suitable for large-scale freight uses such as intermodal and/or large distribution facilities. The inventory should also identify a second tier of smaller sites that have good multi-modal transportation access and can support freight-intensive uses that contribute to the Massachusetts economy. MassEcon has begun similar work by engaging with the Massachusetts Railroad Association to qualify rail-served sites from their SiteFinder database. Completing this work with input from the railroads and economic development officials would provide a strong foundation the inventory of sites.

Freight-Intensive Land Use Development and Preservation

Many parcels of the size, location, amenities, and access characteristics suitable for rail freight operations are currently threatened by development that would preclude their use. For one, many of these parcels are simply being converted or rezoned to non-industrial use. Others are being reduced to a size that is not adequate for freight uses due to “encroachment” of other land uses. Still others are being isolated by development that blocks access to the freight transportation network. Similar issues occur on waterfront parcels in or near ports although these areas often enjoy greater regulatory protections, such as Designated Port Areas and Chapter 91 regulations, than rail-accessible parcels.

Planning for freight-oriented land use and recognition of the essential role that freight and logistics support plays in a modern and sustainable 21st century economy are largely discounted at the local level, and have often been undervalued at the broader Commonwealth and regional levels. Current MGL Chapter 40 programs do not include explicit considerations for the range of freight activity required to support and sustain these development trends.

A successful program to emulate for freight-intensive land use preservation is the existing MGL Chapter 40L, Agricultural Incentive Areas. The Plan recommends that legislation be adopted to allow for an "Industrial Incentive Area" statute. The new statute would keep land use responsibility at the local level, giving the Commonwealth and municipalities the option to designate industrial land suitable for freight-intensive uses as an "Industrial Incentive Area." Once the statute has been adopted and the parcel designation has been approved by a 2/3 vote of the municipal legislative body, sale, or conversion to non-industrial use would require notice from the owner, and the municipality (or Commonwealth) would have a first option to purchase the property at its appraised full market value. Like Chapter 40L, the rationale is that designation of a parcel as an incentive area allows land to remain in a desirable land use under private ownership, but allows the public sector to acquire a parcel before its use is changed.

Pre-Review of Freight-Intensive Development under MEPA

Preserving freight-intensive land uses across Massachusetts would help reduce air emissions and their associated pollutants. This result is in line with many of the goals of MEPA. MassDOT should work with the Executive Office of Energy and Environmental Affairs to develop a streamlined MEPA process for freight-intensive development. In particular, a major freight-intensive development such as a freight village or a distribution site with multiple parcels or phases could be reviewed through a Generic EIR that anticipates key impacts related to the development. This would streamline the environmental process as individual parcels or phases could be quickly and easily reviewed if their characteristics fit within the envelope of impacts established by the GEIR. Depending on the specific situation, a series of Notices of Project Change could be used to address these implementation stages. Alternatively, a Special Review Process could be employed that characterizes impacts and appropriate mitigation commitments for the overall development, with expedited review of successive implementation stages as final development plans are solidified for the parcels within the overall master plan.

5.2.2.2 Funding and Financing

A critical element of improving the Commonwealth"s freight transportation infrastructure is determining practical and innovative mechanisms to finance improvements. Key recommendations include:

- Greater consideration of goods movement in funding allocations;
- Strategic multi-modal investments in projects of statewide significance;
- Creation of an industrial rail access program (IRAP); and
- Increased public-private partnership opportunities and funding.

Greater Consideration of Freight in Transportation Funding Decisions

As demonstrated herein, there is a significant need for infrastructure improvements targeted at goods movement, along with significant public benefits of more efficient, cost-effective, and environmentally-friendly freight. Traditionally, transportation funding decisions, have only considered freight in an indirect manner. This study has compiled data on freight activity for all key facilities and developed a series of data-oriented measures to track freight system performance in Massachusetts. MassDOT will incorporate these key infrastructure condition and performance metrics developed as part of the decision-making process for future transportation investments.

Strategic Multi-Modal Investments

The recent reorganization of the transportation agencies in Massachusetts completes the evolution of Commonwealth transportation from a highway-focused organization to a true multi-modal transportation agency. Consistent with this evolution and supported by the analysis findings in this Freight Plan, there are significant public benefits to be achieved from multi-modal investments in rail, seaport, aviation, and intermodal facilities. The Commonwealth"s traditionally modest direct funding to these non-highway modes is increasingly falling behind other states regionally and nationally. This could be accomplished through a new dedicated funding mechanism within the Commonwealth"s budget, and/or targeting specific multi-modal investment projects that are expected to generate significant public benefits.

Increased Use of Public-Private Partnerships

A major theme of the Freight Plan is that targeted and prioritized freight transportation investment results in both public and private sector benefits for Massachusetts. To realize the benefits projected in the Freight Plan, the Commonwealth can more proactively partner with the private sector on mutually beneficial projects by sharing the upfront capital costs. This is especially true for the rail system. Historically, Massachusetts has encountered substantial policy and legal constraints on its ability to engage in true shared investment for shared benefit arrangements in the Commonwealth"s rail network. However, MassDOT, with a strong legislative finding and specifically authorized program, similar to programs in other states, could broaden the range of potential rail investments that deliver public benefits to the Commonwealth. Other states are increasingly using rail funding mechanisms to cover critical corridor and intermodal facility improvements that emphasize private sector matching funds and prioritization of projects based on quantitative evaluation criteria and cost-benefit analysis.

Industrial Rail Access Program (IRAP)

Rail sidings for industrial use are costly to construct, particularly compared to roadway based connections that are inherently a component of an industrial facility. An IRAP would provide funding assistance for the construction or improvement of railroad tracks and facilities to serve industrial or commercial sites where freight rail service is currently needed or anticipated in the future. The funding program can allow financial assistance to localities, businesses, and/or industries seeking to provide freight rail service between the site of an existing or proposed commercial facility and common carrier railroad tracks. The program is a form of public-private partnership and a logical extension of existing Massachusetts programs to enhance economic development such as the Public Works Economic Development (PWED) and the Massachusetts Opportunity Relocation Expansion (MORE) programs.

The benefits of IRAP programs in Maine, New York and other nearby states currently place Massachusetts at a competitive disadvantage for locating industrial companies on rail-served sites. They typically are funded at modest levels (less than five million dollars per year) and require significant matching funds from the private sector. Massachusetts" current Freight Rail Funding Program is similar in many ways to an IRAP program except that the program"s enabling legislation restricts private companies from using public funds for improvements. In addition, the program has many existing financial obligations, and limited bond capacity. By allowing private companies to use public funds through a new IRAP program these funds could be greater utilized for improvements to privately-owned rail in Massachusetts, thus boosting economic development opportunities and encouraging use of the rail system.

Suggested IRAP requirements should be the inclusion of a competitive grant process with at least 50 percent private matching funds and projects should demonstrate quantitative and qualitative economic benefits such as job creation and retention, and increased state/local tax revenue from the benefiting businesses with mitigation for any impacts on passenger rail services.

MassDOT should develop a pro-active truck parking program to enhance freight flows. Trucks are the dominant mode of transportation of freight into, out of and through the Commonwealth. As a result, trucks contribute to highway congestion, greenhouse gas emissions, and congested parking at roadside rest areas. Working with EPA"s SmartWay program, MassDOT will explore development of safe and efficient truck stops along the Interstate system that will reduce or eliminate idling, and provide for adequate locations for truck staging.

Competitive Federal Funding Programs

The American Recovery and Reinvestment Act (ARRA) of 2009 led to new, competitively funded programs such as TIGER (Transportation Investment Generating Economic Recovery) Grants and the High Speed Intercity Passenger Rail (HSIPR) program. While these programs were designed specifically to provide economic stimulus, their success and the overwhelming demand for these funds suggest that similar future rounds of federal funding and application requirements are likely. Lessons learned from those programs for maximizing funding success are:

- Projects need an existing planning and feasibility analysis.
- Positive cost-benefit analysis and identified sustainable benefits are needed to demonstrate a strong return on investment.
- State and local stakeholder support and funding contributions are needed for a project Multi-modal transportation strategies linking freight and transit will do well in programs such as TIGER.
- Projects with coordinated regional and multi-state elements are positively considered.

As Massachusetts was successful in recent TIGER and HSIPR funding applications, it should continue to position its key Commonwealth and regional transportation investment efforts to be prepared for potential federal funding opportunities.

5.2.2.3 Freight Planning and Policies

In Massachusetts, there are numerous Commonwealth level regulations that affect freight and passenger common carriers. The majority of these programs are directed at protecting public safety. Virtually all truck routes are owned by Commonwealth or local governments, and airports and harbors are owned by public authorities. Principal rail lines are mostly privately owned, although in Massachusetts there is considerable public ownership and shared use of rail lines. As a consequence of this mixed ownership and management, most solutions to freight issues require cooperative action by both public and private sectors. Financing, planning, and other institutional mechanisms for developing and implementing joint efforts have been constrained due to the separation of authority and responsibility among the modes and infrastructure ownership/management. Addressing this situation is projected to positively improve performance of the freight system.

MassDOT should engage in effective multi-modal transportation planning and development.
To further address the issue of inter-regional coordination of mobility, MassDOT should continue to enhance working relationships with neighboring states and regional planning entities, such as

the I-95 Corridor Coalition, and take advantage of the regional cooperation opportunities afforded by active participation in AASHTO"s northeast section, Northeast Association of State Highway & Transportation Officials. A recent example of regional coordination is seen with New England"s vision for high-speed rail and the follow-up coordination between the states on the pursuit of mutually beneficial rail projects.

The challenge to regional approaches to freight mobility includes the need to prioritize corridor projects that may lie outside of Massachusetts" borders. This could mean deferring or sharing federal funds. The Pilgrim Partnership between the states of Massachusetts and Rhode Island, which outlines the conditions for operating MBTA commuter rail to Providence, RI, is an example of how such sharing can be mutually beneficial.

MassDOT may also explore establishment of a formal regional transportation organization that would engage the region"s states in multi-modal, interstate transportation planning and development. Massachusetts has already taken steps in this direction with the ongoing efforts with Connecticut and Vermont related to the Knowledge Corridor rail projects. This example is passenger rail related, but the same concepts may be developed to address goods movement. Federal policy development indicates that future federal funding may be tied to regional coordination and multi-modal corridor programs.

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